THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'MAGAZINE OF BOTANY AND ZOOLOGY,' AND OF LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

REF.

PREFACE TO THE SECOND SERIES.

On commencing a New Series of 'The Annals and Magazine of Natural History,' the Editors trust that they may refer, with some degree of confidence, to the contents of the Twenty Volumes which have been published under their superintendence, as the result of their endeavours to succeed in establishing a comprehensive and permanent Journal of the departments of knowledge to which the work is devoted.

Viewing Natural History, so far as the study of Organized Beings is concerned, as a science each branch of which is essentially connected with the others by principles and phænomena common to all, it has been the object of the Editors to include whatever tended to the advancement of the study both of the Animal and Vegetable Kingdom.

The important duty of making known in this country the labours and discoveries of Foreign Naturalists, the Editors trust has hitherto been to a considerable extent fulfilled, in the great number of Translations and Abstracts from the principal Journals and Memoirs of other countries, and in Notices of Foreign Works in all branches of Natural History, which have been given with a view to enable the lovers of the science to keep pace with its progress in every stage of advancement. In this, as well as in all the other departments of the Journal, the Editors continue to avail themselves of the aid of Dr. William Francis, whose services they take this opportunity of acknowledging, as from the commencement of the Work they have had the advantage of his constant and valuable assistance in its regular superintendence.

With regard to the Naturalists of our own country, it has been a source of great satisfaction to the Editors, that their Journal should have been instrumental, from its circulation at home and abroad, in diffusing a knowledge of their labours: and to what extent it has been efficient for this purpose will be evident from the multitude of references to the original communications which have appeared in it that are to be found in foreign Journals, and in the Reports on the various branches of Natural History by Wagner, Müller, Von Siebold, Erichson, Bronn and others, as may be seen in the translations which have been published by the Ray Society.

Of the manner in which their endeavours have been seconded by the lovers of Natural History, the Editors can speak with much gratification, as the pages of the Annals have been continually honoured with contributions from Naturalists of the first eminence: and they regard as the most satisfactory testimony which they could receive as to the conduct of their Journal, that its successive Volumes have been enriched by the original communications of so great a number.

For the principal Bodies connected with the study of Natural History in this country, the monthly numbers of the Annals furnish an early and faithful record. Authentic reports of the proceedings of the Linnæan, Zoological and Entomological Societies of London, and the Botanical Society of Edinburgh, are officially communicated through its pages.

The commencement of this New Series affords the Editors a fit occasion for expressing a hope that they may now receive an accession to the number of their supporters. They would urge how much their means of giving additional interest and value to the Annals, both as to quantity of matter and engravings, must depend upon the extent of the sale; in the hope that those lovers of Natural History who are not already subscribers may take this convenient opportunity of increasing the number of those by whose support the work has been upheld.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

" .... per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 1. JANUARY 1848.

I.—*On the Recent British species of the genus* Lagena. By W. C. Williamson, Esq.

[With two Plates.]

WHILST I was engaged upon a memoir on the microscopic character of the Levant mud and other recent and ancient oceanic deposits (printed for the forthcoming volume of the Memoirs of the Manchester Literary and Philosophical Society), my friend W. Reckitt, Esq. of Boston placed in my hands some sand obtained on excavating a well near that place, which I soon found to abound in specimens of *Lagenæ**. Subsequently

* This interesting deposit can scarcely be called *recent*, being probably several thousand years old, and yet its geological character is not such as to justify its organisms being introduced into the category of fossils; being merely a beach which has been left permanently dry by the tide. When I wrote the memoir above referred to, I stated " that a considerable portion of the Fen district was once an estuary, which has undergone considerable changes even since the time of the Roman invasion; the old sea-bank having, at that comparatively recent period, been much further inland than at present " (Memoirs of the Manchester Literary and Philosophical Society, vol. viii. p. 56). This estuary has been gradually filled up, the elevation of the coast or the recession of the ocean causing the sandy debris, once forming the bed of the latter, to be converted into dry land, and afterwards covered over with a layer of vegetable mould. Mr. Reckitt's specimen was obtained from a depth of seven feet below the surface, where he found a very fine sand containing carbonaceous fragments, and a large number of the Foraminifera and other microscopic organisms still characteristic of our existing sea-beaches, including many of the rarest as well as the most

Dr. Mantell supplied me with specimens from a similar accumulation at March in Cambridgeshire, equally rich in the same elegant organisms. On comparing these with such published drawings and descriptions of *Lagenæ* as were available to me, it was very evident that both the one and the other were exceedingly incomplete, the drawings being for the most part unrecognizable caricatures, and the descriptions not comprehending half the forms that had come under my notice. Contemplating the production of a brief monograph on the subject, I wrote to J. Gwyn Jeffreys, Esq. of Swansea, soliciting his valuable aid, knowing that he possessed an excellent series of these interesting objects from various British localities. In reply he informed me, that in 1828 he had laid before the Linnæan Society a memoir on the same genus, which memoir the Council of the Society ordered to be published in their 'Transactions.' Mr. Jeffreys however, not being satisfied on some points connected with the natural history of these animals, declined publishing the memoir until he had carried out further investigations, and consequently it was not printed.

This memoir, embodying his views of the genus up to that comparatively early period, he has kindly placed in my hands, and also, with that generous liberality which characterizes the true philosopher, he has forwarded to me his entire collection of *Lagenæ* to be used as I thought proper.

Under these circumstances I resolved upon a revision of the genus, giving figures of all the known British species, believing that the monograph would be neither useless nor uninteresting to the students of these microscopic organisms. The Boston and March deposits have enabled me, from their productiveness, to compare an immense number of specimens, and the two collections of Mr. Jeffreys and Mr. Bean of Scarborough have afforded

common of our British species. The specimen from March, which Dr. Mantell has placed in my hands, confirms my view as to the extent of this marine deposit. I have little doubt that it extends over the greater part of the Fen district, and probably it will be found to be continuous with the existing beaches of the coasts of Lincolnshire and Norfolk. The most curious feature of the deposit, as it exists at Boston and March, is the young state of nearly all the organisms found in it. The specimens of *Rotalina Beccarii*, *Polystomella crispa* and *Quinqueloculina seminulum* rarely exceed the $\frac{1}{80}$th of an inch in diameter, which, with their highly translucent aspect, shows them to be in a very young state. The same remark applies, though in a less degree, to the *Lagenæ*: does not this most strikingly illustrate the sifting power of aqueous currents, and explain the way in which such differences have been produced in rocks, which, like the chalk, have been entirely formed by an accumulation of Foraminifera and other small organisms, which in some localities are exceedingly minute, forming very fine-grained strata, whilst in others they are *comparatively* large, forming deposits of coarse texture?

me the opportunity of verifying the present existence of the same forms on various parts of the British coasts.

The earliest notice of any forms of *Lagenæ* which has come under my observation is in the 'Testacea Minuta Rariora' of Mr. Walker, published in 1784. He describes a number of British species which he arranged amongst the *Serpulæ*, distinguishing them however by the subgeneric name of *Lagena*.

In 1789 and 1791 Soldani figured some forms from the Adriatic, in his 'Testaceographiæ et Zoophytographiæ, parvæ et microscopicæ,' &c., tab. 120.

In 1803 Montagu republished Walker's species in his 'Testacea Britannica,' adding a few others which had been discovered by Mr. Boys of Sandwich. Montagu followed Walker's plan of arranging them with the *Serpulæ*, making them a part of his genus *Vermiculum*.

In 1808 Denys de Montfort introduced the genus into his 'Conchyliologie Systématique,' under the French and Latin generic names of *Lagénules* and *Lagenula*, classing them amongst his *Univalves cloisonnées*, or group of *Nautili*, in which group, like his predecessors Soldani, Plancus, and Fichtel and Moll, he comprehended all the Foraminifera.

In 1815 Dr. Fleming separated them from the *Serpulæ*, and, carrying out the intimation of Walker, gave them the rank of a genus in the article Conchology, published in the 'Edin. Ency.' vol. vii. p. 68. He applied to them the generic name of *Lagena*, very properly adopting the *subgeneric* term given to them by Walker, to whom certainly belonged the credit of pointing out the necessity for distinguishing them from any existing genus. It is to be regretted that Dr. Fleming subsequently abandoned this name for that of De Montfort.

In 1826 M. Dessalines D'Orbigny published his classification of the Cephalopoda*: in this arrangement he followed the views of preceding naturalists, regarding most of the Foraminifera as cephalopodous; but he separated three of the genera, *Lagenula*, *Discolites* and *Chelibs*; having anticipated Ehrenberg's subsequent discovery of the zoophytic character of *all* the Foraminifera, by determining that *these three* must be arranged with the true Polypifera.

At the same time Dr. Fleming, in his work on 'British Animals,' was arranging the genus "*Lagenula*" amongst the Foraminifera, regarding them as Cephalopoda, but with evident misgivings as to his correctness; for he observes, "The place of this genus is far from being satisfactorily determined, and the mi-

* Tableau Méthodique de la Classe des Céphalopodes; Annales des Sciences Naturelles, vol. vii. p. 96.

nuteness of the species composing it presents a great obstacle to an accurate examination."

The more recent writers have followed in the steps of those who preceded them, with two exceptions.

Professor MacGillivray, in his work on the 'Molluscous Animals of Scotland,' &c., made the first attempt to classify the British Foraminifera according to the comprehensive system of D'Orbigny, and at the same time reunited the *Lagenæ* to those organisms from which D'Orbigny had separated them.

In 1839 Ehrenberg laid before the Academy of Sciences at Berlin the brilliant results of his investigations into the structure and relations of the Foraminifera. He completely exploded the long-received opinion that they were Cephalopoda, and proved beyond doubt that they were zoophytic, being in fact Bryozoa allied to *Flustra, Eschara, Cellepora,* &c. In his classification of the Bryozoa according to his new views, of which a copy was published in the 'Annals and Magazine of Natural History' for 1841, vol. vii. p. 302, he places some of the *Lagenæ* at the head of the list of Foraminifera, under the name *Miliola*; apparently considering them the most simple and rudimentary form of that curious group. This is I believe the last published notice of the genus, except what is to be found in Thorpe's 'British Marine Conchology' (which contains no more than had been previously given by Dr. Fleming and other conchologists), and a few remarks in the memoir before alluded to on the microscopic character of the Levant mud.

On subjecting the *Lagenæ* from the Boston and March deposits to a close examination, and especially by adopting Ehrenberg's plan of mounting them in Canada balsam and viewing them as transparent objects by means of transmitted light, I soon observed some interesting facts which had apparently escaped the notice of our British conchologists. One of the first was, that these objects, the whole of which consist invariably of one isolated cell or chamber, require, nevertheless, to be divided into two distinct groups or genera; the one characterized by a long *external* neck or tube, with a small patulous orifice at the free extremity, projecting from the upper part of the cell (see Pl. I. figs. 1, 6, 9 & 10.); whilst in the other there exists a very similar tube, only occupying a reversed position. Instead of projecting *externally,* it descends into the *internal cavity*; still taking its rise from the upper portion of the cell, towards the lower part of the interior of which, the patulous orifice of the tube presents itself when it attains its full length (see Plate II. figs. 14, 16 & 22).

A little time after making this discovery, I received from Dr. Bailey of New York, specimens of *Lagena striata* (which is one of those having an external tube), and attached to it was the

name of *Miliola ficus*; which name had been given to it by M. Ehrenberg. Along with these were specimens of *Lagena globosa* (one of the species characterized by an *internal* tube), to which was affixed by Ehrenberg the very expressive name of *Entosolenia miliaris*? Hence it was evident that the great Prussian naturalist had observed the same peculiarity of structure in the species exhibiting the internal tube, and had given to the objects characterized by it the very expressive name of *Entosolenia*, which name it is my intention to retain, in separating the existing genus *Lagena* into two distinct groups

Beyond all doubt, Ehrenberg, MacGillivray and Fleming are correct in classing the *Lagenæ* near the Foraminifera instead of separating them as was done by Dessalines D'Orbigny. Several of the species, when mounted in Canada balsam and examined under a high magnifying power* as transparent objects, show the whole of the calcareous parietes of the cell to be crowded with innumerable minute perforations; a structure identical with that of *Rotalia Beccarii* and many other well-known Foraminifera, when examined under similar circumstances. Some species exhibit traces of much larger foramina; but whether these are normal or have been the result of accident, I am as yet undecided. The above fact however is sufficient to prove, that in their external microscopic structure there is a close affinity between the *Lagenæ* and the other Foraminifera.

As regards the soft animal of *Lagena*, I have not been able to ascertain that anything has been done, or that any one has hitherto examined it in a living state. This probably arises from the fact that all collectors have obtained their specimens from dried sea sand. Still however some little light may be thrown upon it from the affinity of these objects to the other Foraminifera.

Ehrenberg has investigated the nature of the soft parts of some of the latter group of organisms with considerable success. He considers that each cell of a Foraminifer, except the two first, which he found to contain a transparent substance, is filled with two differently coloured organs, which he regards as the thick alimentary canal; and some granular masses, which he suggests may be ovaries†. He also found that the animals had the power of pro-

* One of one-fourth of an inch focus will suffice.

† In none of the numerous specimens I have examined have I found anything analogous to ovaries. Many of them contain a great abundance of oil-globules, which in the dried specimens become inspissated and hardened, adhering to the sides of the cells, and which on decalcification present an aspect very like that of ova. I suspect that the small round objects found by Dr. Mantell in connexion with the fossilized animal bodies of *Rotaliæ* from the Folkstone chalk may be nothing more than these. At least they are undistinguishable from the recent specimens in my cabinet. See Philosophical Transactions, Part 4 for 1846, tab. 21. figs. 5, 10 & 11.

truding through the foramina in the calcareous cell, long extensile tentacula or pseudopodia; great bundles of filaments, which projected from the surface, and especially from the umbilical region. These tentacula had also been noticed by M. Alcide D'Orbigny (see the Voyage dans L'Amérique Méridionale, tome v. p. 29).

In some further investigations into the structure of these curious creatures, in the memoir above alluded to (which is already printed), I have come to the conclusion that a more or less dense but elastic membrane lines the interior of each cell of the compound Foraminifera allied to *Rosalina globularis*, *Rotalina Beccarii* and the *Textillariæ*, upon which my observations were chiefly made, prolongations of which membrane, injected from within (like the processes which the Echinodermata push through the ambulacral pores), constitute the pseudopodia observed by Ehrenberg and Alcide D'Orbigny; since, however large and distinct may be the foramina in the external calcareous portion of each cell, no trace of these foramina can be found in the membrane which continuously lines the calcareous portions of the cells, when the latter have been removed by acid. This internal membrane appears to have been filled with gelatinous matter, having apparently very little organization—a condition noticed by M. Dujardin, and which led him to regard the Foraminifera as little more than an animated slime encased in an external calcareous shell, and to associate them with the Pseudopodian *Amœba* amongst the Infusoria. When the outer shell is removed by acid, we often find that the different sacs of the inner membrane contain numerous small siliceous organisms, which the animal appears to have swallowed, but which are scattered indiscriminately over the whole of the cell in which they occur, and not confined to any one line, which would have been the case had there been any restricted portion, confined within special and narrow limits, performing the functions of an intestinal canal. Hence it appears probable, that, as in the case of the *Hydra* and some of the lower infusorial animals, the whole cavity of the organism was one sacculated digestive organ, the various cells or divisions of which, in those compound forms which are allied to *Rosalina* and *Rotalina*, are connected together by one or more tubular necks; channels of communication passing through the septa, and along which the food received could pass from one cell to another. How the rejectamenta made their escape is doubtful; possibly, as is the case with the Hydraform Polypifera and many other lower animals, the oral orifice may be at once both mouth and anus.

It will be understood, that, according to these views, the animal membrane which is left after the removal of the calcareous portion is in reality an exact cast of the interior of the latter.

The above opinions are at variance with those of M. Ehrenberg, who considers that the calcareous case of the Foraminifer is merely the dried skin of the animal, containing dendritic calcareous particles, which on the contraction of the skin closes and conceals orifices through which the food is received. His observations which led to the above conclusions were chiefly made upon the curious little *Sorites orbiculus*, Ehr., the *Nummulina nitida* of D'Orbigny. However much this organism may support his opinion, certainly the *Rotalina Beccarii* and similar genera do not. We have no evidence that the *external* parietal foramina have an extensile and contractile property; and even if the large orifices of *Rosalina globularis* had any such power, we have demonstrative proof that the orifices do not penetrate the lining membrane, into the interior of which the food would have to find its way. M. Ehrenberg rests his argument upon the discovery of small siliceous organisms in the interior of the cells. It is possible that the *oral*? orifice may be capable of some degree of extension, allowing the transmission of objects of this kind. In *Membranipora*, *Eschara* and other allied groups, the analogous parietal foramina are obviously employed for no such purpose as the transmission of food, which is received through the large orifice at the extremity of the cell. Though the fact that these latter objects are furnished with true polypes may make a difference, still is it not probable that there may be a resemblance in the functions of such closely corresponding foramina in objects so nearly allied? At the same time I may observe, that I have never found siliceous organisms of any size in the *smaller internal* chambers of *Rosalinæ*, *Rotalinæ*, &c., though the frustules of *Cocconeis*, *Grammatophora* and *Navicula* are not uncommon in the larger cells, where the communicating apertures are proportionately large.

One of M. Ehrenberg's results is much more analogous in some respects to those obtained by Milne Edwards, in his investigations into the structure of *Eschara*. The latter observer has clearly shown that the cells of *this* animal are thickened by external additions of calcareous matter, and that, consequently, the soft animal membrane does not line the internal cavity, but pervades the whole substance of the calcareous cell; the calcareous atoms not being developed *upon*, but *in* the skin of the animal. From this it is evident, that very different modes of growth and development are to be found in animals otherwise closely allied.

I have found that M. Ehrenberg's remarks on the soft animals of the Foraminifera apply strikingly to that of *Rosalina globularis*, but scarcely to any other of those that I have examined. In this species, the animal membrane, lining the smaller cells of what in a shell would be called the spire, is of a rich brown co-

lour, becoming of a paler hue as we approach the larger cells; the terminal ones being almost colourless. In *Rotalina Beccarii* this difference is scarcely to be observed, all the cells being nearly transparent; and in *Polystomella crispa,* the animal portions filling the innermost and outermost cells appear to exhibit no differences of transparency or colour. A slight deepening of the colour is observable in the young cells of *Quinqueloculina seminulum.*

It is from *Rosalina globularis* that the best specimens of the decalcified animal membrane are to be obtained, and from *Rotalina Beccarii* the next; these two, especially the former, preserving their contour the best, owing to the greater density of the lining membrane. In *Polystomella crispa,* and in the *Quinqueloculinæ,* this membrane is so exceedingly thin, and the contained animal matter in such a thoroughly fluid state, that less of a definite form is left on drying the decalcified animal than would result from submitting *Paramecium aurelia,* or many others of the Polygastric Infusoria, to a similar process, corroborating M. Dujardin's observations, though not the inferences which he deduced from them.

On treating various species of *Lagena* with dilute nitric acid, in the same way that I had done the other Foraminifera, the results were of a precisely opposite character to those I had previously arrived at, but analogous to those obtained by Milne Edwards in operating upon *Eschara.* I found a strong animal membrane, which, had the organism not been dried, would evidently have been flexible; not lining the cavity of the cell, but retaining all its external form. This was obtained most easily from *L. lævis,* var. *Amphora* (fig. 3), and *L. striata* (fig. 5), in old specimens of which the decalcified membrane was of considerable thickness. In *L. striata* the membrane was very thin and transparent along the costæ, but in old specimens thick and opake in the intervening spaces, the latter portions being easily separated in the form of long shreds. The same transparency in the membrane was observable in the translucent reticulations separating the areolæ of *Entosolenia squamosa,* the areolæ being opake.

The only species which I have hitherto had the opportunity of examining in a fresh state is the *Lagena* (*Entosolenia*) *marginata,* which was rather abundant amongst the branches of an *Antennularia,* which Mr. Jeffreys sent to me from Falmouth, whilst still moistened with sea-water. In these specimens, no trace of organisation was observable in the soft animal; each cell being filled with a perfectly transparent gelatinous fluid, like that contained in the outermost cell of a *Rotalina,* but even still more completely colourless.

The existence of foramina in many of the species, implying

the presence of pseudopodia, renders it probable that the animal of all the *Lagenæ* will eventually be found to be like that of other Foraminifera, viz. a gelatinous substance capable of projecting minute filaments, used probably as organs of progression, and also of receiving foreign bodies into its interior by means of the tubular orifice, by which substances it is nourished. Whether in any species the orifice at the extremity of the tube be furnished with a ciliobrachiate polype like that of the *Eschara* or not, is doubtful. The peculiarity in the structure of the membranous part of the cell, resembling that of *Eschara* and differing from the *Rotalinæ,* would indicate the possibility of some resemblance in this point, but my observations on *Lagena marginata* render it scarcely probable.

The existence of the internal tube of the *Entosoleniæ,* though so different from what generally occurs amongst the Foraminifera (in which all siphuncular appendages usually project anteriorly and not retrally, as has been already observed by M. Ehrenberg), constitutes no real difficulty in the way of classing them together; since in an elegant species of *Polymorphina,* not uncommon in the Boston deposit, and sometimes occurring on our own coast, the outermost cell is furnished with a precisely similar internal prolongation of the terminal oral? orifice, and which I have not hitherto seen noticed by any observer.

As regards the mode of growth of the *Lagenæ* one thing is certain, viz. that in the young state the cell is very thin, vitreous and transparent, whilst it becomes more and more opake with age. Here again we have another resemblance to *Eschara,* in which the gemmule after fixing itself to some object first covers itself with a very thin calcareous case, which it gradually thickens by the addition of calcareous particles. In *L. striata* the young cells, *which are comparatively small,* are perfectly transparent, whilst the large specimens commonly found in the cabinets of collectors are strong and quite opake* excepting along the costæ. From an examination of an immense number of specimens, it soon became evident to me that the animal must have possessed the power of enlarging and thickening its cell with increasing age. This fact first led me to suspect that in its structure it would approach nearer to *Eschara* than to *Rosalina*; an induction which subsequent investigation confirmed. Owing to its form, the cell could not have been so enlarged if it had been merely a calcareous secretion from an internal membrane. It is only in young specimens of the true *Lagenæ* that the long external neck is found perfect. On older specimens it is almost always worn off: this is especially the case with *L. striata.*

* In some instances this opacity arises from the deposition of calcareous matter, in others from a thickening of the membrane.

If then the *Lagenæ* be true Foraminifera, the next question is, what relationship do they bear to the other organisms of the same group? I apprehend that most if not all the Foraminifera, like other Bryozoa, however large and complicated they ultimately become, commence their existence as single isolated cells, upon or around which others are subsequently built; some linearly, as in *Nodosaria* and *Glandulina*; others spirally, as in *Rotalina*, *Truncatulina*, *Polystomella*, &c.; whilst others again present various modifications of these two types, as *Marginulina*, *Cristellaria*, *Spirulina*, *Quinqueloculina*, &c.

The most simple of the above structures belong to the genera *Nodosaria* and *Dentalina*, and consist only of a few smooth cells piled one upon another with connecting necks. Now a *Lagena*, in its perfect and matured form, must closely resemble the isolated germinal cell of one of these, exhibiting a phænomenon, of which analogues occur in every department of the organic world. It becomes then the most simple and primitive type of the Foraminifera; bearing in this respect the same relationship to the more complex forms that the globule of the *Torula* or Yeast-plant does to *Nostoc*, *Anabaina*, &c. amongst the Confervæ, and that *Eunotia* does to *Fragillaria* and young states of the *Diatomæ* amongst the Diatomaceæ. It is another instance of the *gradation*, so admirably distinguished by Mr. Lyell and Mr. Miller *, from the erroneous and recently abused doctrines of development and progression.

At the same time that the analogy of form and external contour thus links the *Lagenæ* with *Nodosariæ* and *Dentalinæ*, the structure of the cell already described appears to indicate a connexion between them and the genus *Eschara* and its allies. This affinity shows that there are great difficulties in the way of receiving any of the existing linear arrangements of these objects, and that a new classification will be required, based on a much more extended series of observations upon the physiological characters of all the genera than we as yet possess. This subject presents a wide and interesting field of inquiry for those who reside on the sea-coast and have access to these objects in a living state.

The only general fact which remains to be noticed respecting the *Lagenæ*, is the extraordinary capacity for variation which they exhibit in different states and ages. Extreme forms which appear to be very distinct from one another may be connected together by specimens of an intermediate aspect to an extent only to be believed by those who examine a large series of specimens side by side. I am well aware that the synthetical plan which I have

* 'Old Red Sandstone,' by H. Miller, Esq., p. 52.

followed will not suit the views of many of my conchological friends, who would have preferred my multiplying the number of species to a far greater degree than I could approve. I have however endeavoured to compromise the matter with them by giving names to what I consider to be merely varieties, but which some would regard as good species. Those who prefer the latter view can act upon it if they choose, by adopting these names as specific ones. This capacity for variation is probably a characteristic of very many of the lowest forms of animal and vegetable organizations, and is a source from which more or less of difficulty will always arise in attempting to classify objects so small in their dimensions and so obscure in their nature. In the present case it would scarcely be a difficult task to exhibit every intermediate form between *Lagena lævis*. var. *Amphora* to *L. striata* and *L. substriata*, rendering it possible that they may be all varieties of *one* species.

The *Lagenæ* are usually found in dried sea-sand, free and detached, though Prof. MacGillivray observed *Lagena lævis* to be adherent to Fuci and the byssus of a *Modiola*; and amongst the branches of an *Antennularia* sent to me from Falmouth by Mr. Jeffreys were numbers of the *Entosolenia marginata* along with *Rosalina globularis* and *Polystomella crispa*.

In dividing the objects comprehended by Dr. Fleming, in De Montfort's genus *Lagenula*, into two groups, I have retained for the first of these Walker's term *Lagena*. Though the latter did not make them into a new genus, separate from *Serpula*, yet he distinctly indicated the necessity for a division, pointing out certain well-marked forms, and giving them a distinguishing name. In this he accomplished more than was subsequently effected by De Montfort; hence, in raising them to the rank of a genus, priority gives his name of *Lagena* the right to a preference before that of *Lagenula*. The adoption of the latter by English conchologists was owing to its introduction by Dr. Fleming into his 'British Animals,' where he employed it, I understand, because of its being more euphonious than *Lagena*, notwithstanding that, as has been already mentioned, he had previously adopted Walker's very expressive term for the genus in the 'Edinb. Encyclopædia' (vol. vii. pl. 1. p. 68, art. Conch. 1815). A slight improvement in the sound, or even expressiveness of a name, does not justify its displacing an older one, and hence throughout this memoir I have retained that of *Lagena* in preference to *Lagenula*.

Genus LAGENA, *Flem. Edin. Enc.*

Serpula (*Lagena*), Walker. *Serpula*, Turton. *Vermiculum*, Mon-

tagu. *Lagenula*, De Montfort, Fleming, MacGillivray. *Miliola*, Ehrenberg.

Cell calcareous, single, globular, ovate or cylindrical, with a long produced external tubular neck projecting from the upper extremity. Internal cavity simple.

1. *Lagena lævis*. Pl. I. figs. 1, 2.
   Serpula (*Lagena*) *lævis ovalis*, Walker, Test. Min. Rar. p. 3. t. 1. fig. 9.
   Vermiculum læve, Mont. Test. Brit. p. 524.
   Serpula lævis, Turton, Conch. Dict. p. 157.
   Lagenula lævis, Flem. British Animals, p. 235; MacGillivray, Molluscous Animals of Scotland, p. 38.

Cell ovate or claviform, sometimes narrow and much elongated, having a long slender tubular neck somewhat contracted near its apex, surmounted by a narrow rim, surrounding a small circular oral ? orifice, smooth and shining, sometimes white, but more frequently transparent and hyaline, or with a delicate tint of bluish white: under a high magnifier its surface appears crowded with very minute foramina.

In its usual form, with the exception of the terminal rim, this delicate object bears the closest resemblance to a Florence flask. Fig. 2 represents a longitudinal section.

Long.	Diam.	Long.	Diam.
$\frac{1}{50}$	$\frac{1}{220}$	$\frac{1}{100}$	$\frac{1}{230}$ *
$\frac{1}{88}$	$\frac{1}{187}$	$\frac{1}{107}$	$\frac{1}{250}$

Scarborough, very rare, W. Bean, Esq. Swansea, Sandwich, J. G. Jeffreys, Esq. "Adhering to Fuci, and among the byssi of *Modiola barbata*, on the Girdleness at Aberdeen," Prof. MacGillivray. Boston, Lincolnshire; March, Cambridgeshire.

L. lævis, var. *a*. *Amphora*, nob. Figs. 3, 4.

Cell elongated, cylindrical; some examples having the form of *L. lævis*, with the addition of a long tapering mucro at the base; others being much more lengthened and fusiform, as in the figure. The majority of specimens exhibit a medium form, the greatest diameter being at the lower third of the cell. Neck long, slender, tapering, surmounted by a small rim surrounding the circular orifice. Texture and hue like *L. lævis*, of which I believe it to be only a variety, as I have found almost every in-

* In order to give a correct view of the variable dimensions of these objects, I have selected several specimens and given the length and breadth of each individual in fractional portions of an inch. The dimensions of all the species, as described by preceding writers, are very much larger than in any examples which have come under my notice and are surely inaccurate.

tervening form between the figures 1 and 3. It is one of the most elegant of the *Lagenulæ*.

Long.		Diam.
$\frac{1}{40}$	....	$\frac{1}{180}$
$\frac{1}{66}$	....	$\frac{1}{170}$
$\frac{1}{45}$	....	$\frac{1}{200}$

Oxwich, Sandwich, Oban, J. G. Jeffreys, Esq. Boston; March.

2. *Lagena gracilis,* nob. Pl. I. fig. 5.

In form this species bears a very close resemblance to the *L. lævis,* var. *Amphora,* from which it differs chiefly in having its surface marked by longitudinal striæ, which are well defined over the greater part of the cell, becoming less distinct towards the upper portion. If we consider this as only another variety of the *Amphora,* it will become necessary to regard all the forms of *L. striata* merely as states of *L. lævis,* of the propriety of which view a suspicion has more than once crossed my mind when examining some specimens of the var. *β. semistriata.* For the present I have thought it better, having seen several specimens of it, to give it a distinct name. If this suspicion should ultimately prove to be correct, *L. gracilis* will bear the same relation to *L. striata* and its var. *perlucida* that the var. *Amphora* does to *L. lævis.*

Long. $\frac{1}{55}$; diam. $\frac{1}{380}$.
Boston: very rare.

3. *L. striata.* Pl. I. figs. 6 & 8.

Serpula (*Lagena*) *striata,* Walker, p. 2. tab. 1. fig. 6.
Vermiculum striatum, Mont. Test. Brit. p. 523.
Serpula striata, Turton, Conch. Dict. p. 157.
Lagenula striata, Fleming, p. 234.

Cell ovato-claviform or spherical, with numerous parallel longitudinal costæ or lamellæ, which generally run nearly from one extremity to the other, only not usually reaching the apex inferiorly but terminating abruptly, forming a small circular coronal (see fig. 7). These costæ are sometimes very thin and lamelliform, but more commonly obtuse and rounded. The cell surmounted superiorly by a long tubular neck terminated by a narrow rim encircling the small round oral ? orifice.

Nothing can be much more variable than the conditions under which this species presents itself. In small young specimens alone is the tubular neck found perfect, and these are usually either transparent and hyaline or of a pale bluish white. On the other hand, the specimens usually seen in the cabinets of conchologists are strong, globular, of an opake dirty white, the rounded costæ alone remaining semitransparent, and with very imperfect

traces of a neck, which appears to wear away with age. Between this common form and that previously described, which I consider to be the perfect type, every modification exists. In some forms the costæ terminate abruptly near the base of the neck, the superior portion being smooth. This condition obviously connects the *L. striata* with the var. *β. semistriata.* In others the costæ are continued longitudinally along the neck, whilst in a few elegant specimens in the cabinets of Messrs. Bean and Jeffreys they were wound spirally around it. In some examples I have noticed that the neck appeared to be atrophied and wasting, having lost its brittleness and become membranous, as if it were only of use in the early condition of the animal. The character of the decalcified membrane of this species has been already described (p. 8).

Long.	Diam.	Long.	Diam.
$\frac{1}{50}$ . . .	$\frac{1}{60}$*	$\frac{1}{80}$ . . .	$\frac{1}{160}$
$\frac{1}{50}$ . . .	$\frac{1}{100}$		

"Reculver, Sheppey, Mr. Walker. Devonshire," Montagu. Exmouth, — Clarke, Esq. Swansea, Rossilly, Manorbeer, Tenby, Oxwich, Caswell Bay, Sandwich, Oban, Kyleakin; Roundstone, Connemara; Mr. Jeffreys. Scarborough, Mr. Bean. Boston; March. Fossil in a miocene tertiary deposit at Petersburg, U. S.†, Dr. Bailey; also in the English crag, Mr. Searles Wood.

L. striata, var. *a. interrupta,* nob. Fig. 7.

Like *L. striata,* only the costæ are more irregular; sometimes they bifurcate, at others they are not continued over more than the half or two-thirds of the cell, no two being exactly the same length. The specimen figured represents a common form of the neck when half-gone.

Swansea, Rossilly, Manorbeer, Tenby, Oxwich, Caswell Bay, Sandwich, Oban; Roundstone, Connemara; Kyleakin. Scarborough, Mr. Bean. Boston; March. Not uncommon.

Lagena striata, var. *β. semistriata,* nob. Pl. I. figs. 9, 10.

Similar in most respects to some young states of *L. striata,* only the costæ arising from the base terminate, some at the lower third, others at the middle, and in one specimen towards the uppermost third of the cell. What has been already said of the smooth neck found in some specimens of *L. striata* convinces me that this is only a variety. I have seen one specimen with a mucro at the base approaching the form of *L. lævis,* var. *Amphora.*

Long. $\frac{1}{100}$; diam. $\frac{1}{226}$.

* In this specimen nearly the whole of the neck is worn away.

† The same deposit has also furnished examples of *Entosolenia globosa, Arethusa lactea,* Flem., *Renoidea oblonga,* Brown (both species of *Polymorphina.* D'Orbigny), and what I believe to be young specimens of *Rotalia Beccarii.*

Manorbeer near Tenby, very rare, Mr. Jeffreys. Scarborough, one specimen, Mr. Bean. Boston.

Lagena striata, var. *perlucida.* Pl. I. fig. 11.

Cell usually globular, sometimes broadest at the base, at others ovate. Marked with longitudinal costæ, which are very distinct at the lower portion, but gradually lose themselves as they approach the long, elegant, tapering neck. In this it differs from the last var., in which the striæ terminate abruptly at the upper part. Cell exceedingly thin and fragile, beautifully hyaline and pellucid, sometimes of a pale milky tint, but more commonly transparent as the purest glass.

I believe this to be the *Vermiculum perlucidum* of Montagu: his figure represents a highly depressed form of cell, furnished with a small umbo at the base; but as Montagu had never seen the specimen, but only copied a drawing sent to him by Mr. Boys, I suspect that some error exists. I have often seen the projecting base of the central costa give the appearance of an umbo, and as regards form I have observed very great differences. The number of the ribs varies considerably. Some specimens, like Montagu's *V. perlucidum,* have not more than seven or eight, whilst in others they increase in number so as to merge this variety in the ordinary forms of *L. striata,* of which species I believe it to be one of the young states. Its most common aspect is precisely that of the ordinary fluted water-bottle used at the dinner-table. Sometimes the striæ are so short and indistinct as to render the specimen almost undistinguishable from *L. lævis*; indeed in some few specimens the striæ are only represented by a small circle of minute tubercles forming a coronal at the base of the cell.

Long.		Diam.
$\frac{1}{66}$	....	$\frac{1}{120}$
$\frac{1}{88}$	....	$\frac{1}{185}$
$\frac{1}{110}$	....	$\frac{1}{240}$.

Swansea, Tenby, Manorbeer, Sandwich, Kyleakin, Mr. Jeffreys. "Seasalter, Mr. Boys." Montagu. Boston; March.

4. *L. substriata,* nob. Pl. II. fig. 12.

Cell oval, sometimes considerably elongated and cylindrical, furnished with a long tubular neck. Surface marked with numerous exquisitely delicate parallel longitudinal striæ.

At first I thought that this rare object was an extreme variety of *Lagenula striata,* but after examining at least twenty specimens I am nearly satisfied that it is a distinct species, as the lines vary so little either in their number, strength, or distance apart. The general form of the cell also is much more ovate and elongated.

The drawing represents a specimen that is the least so. It is an exceedingly delicate and beautiful species.

Long.		Diam.
$\frac{1}{65}$	....	$\frac{1}{150}$
$\frac{1}{66}$	....	$\frac{1}{200}$.

Swansea, very rare, Geo. Barlee, Esq. Boston.

Genus Entosolenia, *Ehrenberg.*

Serpula (*Lagena*), Walker, Adams, Turton. *Vermiculum*, Mont. *Lagena* and *Lagenula*, Fleming. *Lagenula*, MacGillivray, Thorpe.

Cell calcareous, globose or ovate, sometimes compressed, furnished with a tube arising from the upper extremity and projecting downwards into the cavity of the cell. Oral? orifice opening into the tube.

1. *E. globosa.* Pl. II. figs. 13, 14.
   Serpula (*Lagena*) *lævis globosa*, Walker, p. 3. tab. 1. fig. 8.
   Vermiculum globosum, Mont. p. 523.
   Serpula globosa, Fleming, p. 235.

Cell ovato-globose, smooth, not compressed, projecting slightly at the upper extremity, in the centre of which projection is the small rounded orifice opening into the internal tube, which is slender, patulous at the extremity, and sometimes reaching nearly to the bottom of the cell.

When examined under a very high power, this object, like *L. lævis*, is found to be densely perforated with minute foramina, through which in all probability pseudopodia were protruded.

In very many cases I am satisfied that specimens of my *E. lineata* have been mistaken for this very rare form.

The cabinet of Mr. Bean of Scarborough contains one example of this species, in which two separate cells are united together at the lower part, having each a central aperture at the opposite end. The *Lagenula globosa* of Thorpe's 'British Marine Conchology' is obviously not the *L. globosa* of Fleming. It is described as having a long slender neck and is marked with opake longitudinal lines.

Long.		Diam.
$\frac{1}{100}$	....	$\frac{1}{160}$
$\frac{1}{166}$	....	$\frac{1}{170}$
$\frac{1}{166}$	....	$\frac{1}{214}$.

"Sandwich, Mr. Walker," Montagu. Scarborough, Mr. Bean. Portsmouth, Swansea, Mr. Jeffreys. Mindanao, Philippine Islands, and fossil in a miocene tertiary stratum, Petersburg, U.S., Dr. Bailey. Boston, March, the Levant. A rare species on the British coasts.

2. *Entosolenia marginata.* Pl. II. figs. 15, 16.
Serpula (Lagena) marginata, Walker, p. 3. tab. 1. fig. 7.
Vermiculum marginatum, Mont. p. 524.
Lagenula marginata, Thorpe.

Cell nearly orbicular, compressed, transparent or translucent, especially in a young state, having a slight projection at the upper extremity, towards the end of which is the orifice communicating with the internal tube. The cell is surrounded by a thin marginal lamella, which is continued as far as the oral orifice; within this margin, in old shells, is occasionally a thickened opake portion shaped like a horse-shoe, with the concavity and interrupted part directed upwards, the circumscribed central portion being more transparent. The lower extremity of the cell is sometimes furnished with a small external mucro. The internal tube, which is somewhat patulous, is rarely straight, except at the upper portion, the remainder being usually arcuated, following the curvature of one of the lateral parietes of the cell. Fig. 15 represents a section of the cell, with the tube cut across where the curvature commences.

This is the most common of our English species. At the Falmouth habitat it was comparatively abundant, adhering to a species of *Antennularia*, along with young forms of *Polystomella crispa*, *Rosalina globularis* and some others.

The *L. marginata* of Dr. Fleming is a concamerated shell; the *Rimula marginata* of some authors, and belonging to D'Orbigny's genus *Biloculina*.

Long.		Diam.
$\frac{1}{100}$	....	$\frac{1}{110}$
$\frac{1}{166}$	....	$\frac{1}{214}$
$\frac{1}{200}$	....	$\frac{1}{210}$

Swansea, Rossilly, Manorbeer, Portsmouth, Sandwich, Oban, Kyleakin, Mr. Jeffreys. Scarborough; Lamlash Bay, Ayrshire; Mr. Bean. "Reculver," Walker. Boston, March, Falmouth, the Levant.

E. marginata, var. *lucida*, nob. Pl. II. fig. 17.

Cell elongated, somewhat pyriform, compressed, smooth and shining, surrounded by a marginal ring, which instead of being a thin lamina as in the ordinary type, is usually thickened and somewhat rounded. It is occasionally scarcely visible, especially towards the base, where however it often projects in the shape of a mucro. This margin, with the upper and central portions of each of the lateral parietes, are generally transparent, whilst the remainder of the cell is usually of a clear shining white; internal tube generally straight.

I was much disposed to have regarded this as a distinct spe-

cies, but I found many orbicular specimens of the true *E. marginata* in which the margin was obviously somewhat thickened and rounded, and others which, as already mentioned, showed the horseshoe-like white portion within the margin, nearly surrounding the transparent centre, so that I have no doubt of this being merely a variety of the same. It is often mistaken by collectors for a form of *E. globosa,* to which it sometimes approximates very closely, but from which it may be distinguished by its compressed form.

I have seen one specimen which was trilocular, having three transparent margins instead of two.

Long.		Diam.
$\frac{1}{63}$	....	$\frac{1}{160}$
$\frac{1}{80}$	....	$\frac{1}{133}$
$\frac{1}{100}$	....	$\frac{1}{160}$

Swansea, Rossilly, Manorbeer, Portsmouth, Sandwich, Kyleakin, Mr. Jeffreys. Scarborough, Lamlash Bay, Mr. Bean. Boston; March.

3. *Entosolenia lineata,* nob. Pl. II. fig. 18.

Cell ovate, broadest towards the base, more or less truncated at the upper extremity, which is sometimes furnished with a very small projecting neck, of variable length, in which is the oral? orifice; once only I have found it equal to the entire length of the cell. The base, which is rounded, has generally appended to it a small mucro, which is sometimes affixed obliquely, and occasionally wholly wanting. Texture translucent, of a pale dull bluish white; the surface covered with exceedingly numerous longitudinal lines, so fine as to be visible only under a good microscope. Internal tube straight, patulous, reaching nearly to the base of the cell.

The dull leaden hue of this species appears to be a constant characteristic; I have usually been able to identify it at a glance from this feature alone.

It is possible that the *Vermiculum urnæ* of Montagu may have been a short stumpy specimen of this form. Montagu only saw a drawing of it.

Long.		Diam.
$\frac{1}{113}$	....	$\frac{1}{214}$
$\frac{1}{128}$	....	$\frac{1}{200}$

Sandwich, Mr. Jeffreys. Boston; March: very rare.

4. *E. squamosa.* Pl. II. fig. 19.

Vermiculum squamosum, Mont. p. 526. tab. 14. fig. 2.
Serpula squamosa, Turt. p. 158.
Lagenula squamosa, Flem. p. 235.
Lagenula reticulata, MacGillivray, p. 28.

Cell ovato-globose, with a slight projection superiorly, at the extremity of which is the small circular oral? orifice. Surface beautifully ornamented with numerous, small, white, concave, irregular, areolar spaces, separated by elevated, transparent, reticular lines of demarcation. These areolæ are irregular in form and distribution, being sometimes nearly round or oval, but more usually exhibiting a marked tendency to become hexagonal, the lower ones being usually the most elongated. Occasionally the areolæ are transparent and the reticulations milky. In this state it appears to be the *L. reticulata* of MacGillivray: one part of his description alone does not agree with my specimens; he speaks of its being "considerably compressed." This however may have been an accidental circumstance, as all the species, both of *Entosolenia* and *Lagena*, are liable to a considerable degree of deformity. Internal tube patulous, usually shorter than in *E. globosa*, and generally with a small dilatation or spherical cavity a little below the oral? orifice. The base of the cell is sometimes, though rarely, furnished with a small umbo.

In the figure of this exceedingly variable species, given in the Supplement to Montagu's 'Testacea Britannica,' the areolæ are made to represent scales overlapping each other. This appearance, though not natural, is easily obtained, by viewing the object obliquely and by throwing the microscope a little out of focus, and I have no doubt would be the aspect presented by the object when viewed under the imperfect instruments used in the time of Mr. Walker. Dr. Fleming considers these areolæ to be "parietal cells." They are however merely concavities in the exterior of the cell. They are usually to be traced in the form of opake spots in the decalcified membrane.

I possess one curious abnormal double specimen of this species, like that of *E. globosa* already described. There are *two* cells, united inferiorly, and having each one *central* oral? orifice at the opposite extremity.

Long.		Diam.
$\frac{1}{100}$	....	$\frac{1}{133}$
$\frac{1}{115}$	....	$\frac{1}{150}$
$\frac{1}{166}$	....	$\frac{1}{190}$

"Seasalter, Mr. Boys," Montagu. Torbay, Swansea, Mr. Jeffreys. Lamlash Bay, Ayrshire, Scarborough, Mr. Bean. "Bay of Aberdeen," Prof. MacGillivray. Boston; March: rare.

Entosolenia squamosa, var. *a. catenulata*. Pl. II. fig. 20.
Lagenula catenulata, Jeffreys MSS.

Cell ovato-globose, usually hyaline and transparent; areolæ very small and numerous, square or hexagonal, arranged in perpendicular rows, having parallel horizontal divisions, which are

sometimes straight and at others arcuated. This form is merely the *E. squamosa* with the areolæ in perpendicular rows instead of being irregularly distributed over the surface. Sometimes these areolæ exhibit a tendency to assume the ordinary white opake appearance of the common form. I have seen specimens in which one side exhibited the arrangement in fig. 19, and the opposite one that of fig. 20; thus showing the identity of the two forms.

Long. $\frac{1}{100}$; diam. $\frac{1}{144}$.

Swansea, Sandwich, Mr. Jeffreys. Boston: very rare.

Entosolenia squamosa, var. *β. scalariformis,* nob. Pl. II. figs. 21, 22.

Closely resembling the last in the distribution of its areolæ, only they are very large and few in number; usually square or hexagonal, the horizontal lines of division being most frequently a little arcuated. The texture of this variety is highly hyaline, and commonly occurs amongst the young states of *E. squamosa.* As in the preceding example, I have seen specimens in which one side exhibited the arrangement of the areolæ, characterising the present form, whilst the opposite one presented that of the succeeding variety.

Long.	Diam.
$\frac{1}{100}$	$\frac{1}{144}$
$\frac{1}{133}$	$\frac{1}{200}$

Kyleakin, Mr. Jeffreys. Lamlash Bay, Ayrshire, Mr. Bean. Boston; March: very rare.

E. squamosa, var. *γ. hexagona.* Pl. II. fig. 23.

Areolæ large, hexagonal, concave, not arranged in well-marked perpendicular rows. The cell is often more conical, opake, and of a browner aspect than in the other forms, but numerous intermediate specimens link them all together, both as regards the colour, form and arrangement of the areolæ.

Long. $\frac{1}{133}$; diam. $\frac{1}{200}$.

Oban, Kyleakin, Mr. Jeffreys. Lamlash Bay, Scarborough, Mr. Bean. Boston; March: very rare.

The *Vermiculum lacteum* of Montagu is not a *Lagena,* but the *Arethusa lactea* of Fleming, a species of *Polymorphina* of D'Orbigny. *Vermiculum retortum,* Mont., is a very young state of one of D'Orbigny's family of *Agathistègues,* probably the *Vermiculum bicorne,* Mont. *Vermiculum urnæ* of Montagu, as I have already stated, I believe to be the same as my *Entosolenia lineata.* Mr. Jeffreys suspects it to have been the ovary of a coralline. The *Lagenula marginata* of Fleming belongs to D'Orbigny's genus *Biloculina.*

Manchester, June 25, 1847.

II.—*Note on the genus* Cypridina, *M. Edwards; with a description of two new species.* By W. Baird, M.D., F.L.S. &c.

[With two Plates.]

The genus *Cypridina* was founded by M. Edwards in 1838, in a note to the second edition of Lamarck's 'Hist. Nat. An. sans Vertèbres,' and was afterwards more fully detailed in the third vol. of his 'Hist. Nat. des Crustacées.' The animal resembles a good deal in its general form and structure that of the genus *Cypris*. From his observations however it appears to have two eyes, distinct from each other; two pairs of antennæ, both pediform; one pair of natatory feet, and a peculiar organ apparently for supporting the ova, similar in purpose to, but differing in structure from, the second pair of feet in the *Cypris*. In 1840 M. Philippi published a paper in the sixth vol. of the 'Ann. and Mag. Nat. Hist.' in which he describes and figures a small Entomostracan allied to the genus *Cypris*, and to which he gives the name of *Asterope*. In some of its characters as given by him, it differs from the *Cypridina* of Edwards,—points of difference which he particularly mentions,—but in others it resembles it very closely. I have very lately had opportunities of examining two species of Entomostraca which I can only refer to the genus *Cypridina*, and which, upon dissection, I found in several of its parts to partake of the nature and form of that genus, and in other parts to resemble *Asterope*. From this mixture of the characters of the two genera, and taking into consideration the minuteness of the parts examined, and the different appearance these same parts assume in different positions under different microscopes and with different observers, I am inclined to believe these two genera to be identical. Waiting however till better opportunities occur for examining these little creatures, I shall content myself at present with describing two new species that have lately occurred to me.

Sp. 1st. *Cypridina MacAndrei*. Pl. VI. *B*. figs. 1, 2. Shell of an oval shape; the two extremities prolonged into sharp points; that of upper extremity curved and projecting forwards and a little upwards, that of inferior extremity projecting a little backwards. The whole shell is dotted over with small spots. On anterior edge near the upper extremity the shell is deeply notched. It is smooth and of a light colour (dry).

Several specimens of this little animal were placed in my hands by Mr. M'Andrew, who dredged them in deep water off the Shetland Isles. They were preserved dry, the whole animal being of the size of a small pin's head, and the shell being tolerably hard. In consequence of having been kept thus dry for a considerable time, the animal had become so shrunk that it was with consi-

derable difficulty I succeeded in dissecting it. For the accompanying sketches of this species I am indebted to the pencil of Mr. Charles Ager.

The eyes I did not succeed in making out. The first pair of antennæ (Pl. VI. fig. 3) are large and pediform: they consist each of four articulations. The first or basilar joint is stout and of a considerable size; the second is nearly equally large; the third is short, about half the size, and the last is more slender and terminated by several strong setæ. From the junction of the third and fourth joints issues a bundle of long slender setæ as in *Cypris*, and the second articulation is beset on both upper and under edge with numerous strong setæ also. The organ which he calls the natatory foot (fig. 4) is however a very remarkable one: it consists of a very large, fleshy, round basilar joint, from which issue two branches separate from each other and differing in size and structure. The superior is much the larger of the two, and consists of one long and stout joint and six short ones, from the base of each of which issues a long hair. The inferior branch is much smaller and consists of two nearly equal joints, the lower terminating in two short claws. According to the figure given by M. Edwards, this pair of feet consists of only one branch instead of two. The mandible I did not succeed in seeing; but the first pair of jaws appeared to be very like that organ as represented by M. Edwards. The second pair of antennæ presented the appearance given in fig. 5, but the parts were too rigid to enable me to describe it distinctly. On the posterior portion of the animal there was another organ, which is described by M. Edwards in the *Cypridina* as a slender, cylindrical, filiform and twisted body which supports the ova. In this species it appeared a cylindrical body (fig. 6) composed of a very great number of small joints, of a twisted form, and giving off from each side several pretty long setæ which appear numerously jointed also and furnished at their extremities with sharp spines. It resembles more the same organ as described in the *Asterope* by Philippi than that in the *Cypridina* of Edwards. The abdomen is terminated by a double caudal plate (Pl. VI. fig. 7), broad, flat, and armed with nine spines; six of which are very strong and serrated on their under edge. The first is the longest and they gradually become shorter as they descend, the three last being much smaller than the others, not serrated on their under edges, but furnished with a tuft of short setæ at their extremities. This caudal plate appears to be a simple continuance of the abdomen, and not articulated with it as in the tail of *Cypridina* figured by M. Edwards, and in this particular resembles much more nearly that organ as represented by Philippi in his *Asterope*.

Sp. 2nd. *Cypridina Adamsi*. Pl. VII. fig. 1. Shell of the size

of a small pea, of an oval form and very convex, rounded at the base and somewhat pointed at its apex, under which anteriorly it is deeply notched. The shell is smooth, shining, and of a pale yellow or cream colour (dry).

Two or three specimens were brought home by Mr. Arthur Adams, Assistant Surgeon Royal Navy, attached to H.M. Ship 'Samarang,' who dredged them during the late voyage of that vessel in the South Atlantic Ocean. They had as well as the preceding species been preserved dry, and from the long time they had been kept so, it was almost impossible to dissect the animal. However by steeping them in spirits of wine for some time, I succeeded in obtaining the body of the animal sufficiently entire to be able to ascertain the genus. The anterior antenna (fig. 2) consists, as in the preceding species, of four joints, the three last having numerous pretty long plumose setæ springing from the upper edge, and the last being terminated by a tuft of similar but longer setæ. The natatory foot (fig. 3), as in the other species, consists also of a very large basilar joint which gives origin to two branches; the upper of which consists of one very long joint and six very short ones, from the base of each of which issues a long plumose seta. The oviferous foot (Pl. VII. fig. 4) resembles very much that of the preceding species, being cylindrical, and beset at its upper extremity with spines. The jaws and tail resembled very much the same organs in *C. Mac-Andrei*, but the body of the animal was too much decomposed to allow me to see them sufficiently accurately to be able to figure them.

Godeheu de Riville, in his paper on the Luminosity of the Sea, published in 1760 in the third vol. of the 'Mémoires pour les Savans Etrangers,' describes a small Entomostracan which must belong to this genus. Sailing along the coast of Malabar, when in 8° 47′ N. lat., and in 73° E. longitude of Paris, the sea was observed to be unusually and most brilliantly luminous. Having had his attention previously directed to this interesting phænomenon, Riville determined to ascertain the cause. The water all round the vessel and to a considerable distance from it was white as snow, and in the wake of the ship innumerable star-like bodies of a still brighter lustre sparkled on the surface of the agitated surf. He had some water drawn up from alongside, and he then observed numerous bright sparkling spots in the bucket in which it was contained. Pouring it out upon a piece of linen, numbers of small bodies still giving out light were observed adhering to the surface of the cloth. They were alive, and resembled, he says, "those small insects called in France *Puces d'eau.*" The body of the animal was contained in a little shell which was transparent, and resembled in form an almond cleft on one side and

notched at the superior part. The animal, besides several organs which he shortly describes, had, he remarks, "a large foot armed with a toothed talon resembling that of the *puce d'eau*, and destined for the same uses, being a kind of rudder which enables the insect to move about with swiftness." An officer on board made several sketches of this interesting little creature, and from these and the above description I have little doubt of its belonging to this genus*. Riville does not mention the size of his insects, but from what he says they must have been much smaller than the species above described. Amongst the very interesting drawings of Crustacea made by Mr. Adams during the voyage of the 'Samarang', there is one which appears to be another species of this genus. It was taken in the Sooloo Sea. Mr. Adams describes it as of a bluish colour, semi-opake, two lines in diameter, and very quick in its motions, darting about with great velocity and constantly revolving. The figure however is not sufficiently detailed to enable me to describe the species, and no specimens were brought home. Mr. Adams observed both of these species to be highly luminous.

British Museum, October 1847.

Postscript.

Since the above was in type I have had an opportunity of examining another specimen of the *Cypridina Adamsi*, kindly placed in my hands by Mr. Adams. Though equally dry as the other specimens I had previously received from the same gentleman, the body of the animal was almost entire, and I was thus enabled to make out the anatomy more satisfactorily. The eyes are two in number; each placed upon a conical lengthened peduncle, which takes its origin near the base of the first pair of the pediform antennæ. From the state of the animal I could not distinctly make out the construction of the organ, but apparently it was composed of numerous crystalline lenses. The oviferous feet, placed on each side of the body and directed upwards, consist each of a long cylindrical body, club-shaped, composed of a great number of short articulations, and furnished with many stout barbed spines arising from each side. The articulations are completely circular, and with a high power can be discerned running round the body of the foot like a bell-wire (fig. 4 *a*). The spines on its edges are composed of a long basal joint, smooth for three-fourths of its entire length, and five or six very short articulations at the apex, each armed with a short awn-like seta on either side (fig. 4 *b*). The second pair of antennæ (fig. 5) are each formed of three joints. The basal is stout and fleshy, and has at its posterior extremity an appendage consisting of a

* Müller however quotes it as resembling his *Lynceus brachyurus*!

semicircular plate, armed at its edge with numerous slender setæ. The second is shorter and has several long plumose hairs springing from its inferior edge, and three or four not plumose from the upper surface. The terminal joint gives off at its apex four stout setæ, and numerous others more slender from its upper edge. The first pair of jaws (fig. 6) consists each of a semicircular plate furnished on its convex margin with a great number of long beautifully plumose filaments, and has attached to one extremity two other plates, each provided with numerous very slender setæ on their edges. The second pair of jaws (fig. 7) consists each of a semicircular plate furnished on its inner margin with numerous long slender setæ disposed like the teeth of a comb. At one end it gives off a stout branch like a finger, which is terminated by seven or eight long curved spines, and at the other sends off seven or eight long stout plumose setæ. The organs represented at fig. 8 are perhaps the mandibles, but as I did not observe their exact situation in the animal, I cannot with certainty refer them to those organs. The part represented (fig. 9) is unique, but I do not know its nature or use.

EXPLANATION OF PLATES VI. B. and VII.

Plate VI. B. *Fig.* 1. *C. MacAndrei*, highly magnified.
Fig. 2. The outer shell removed to show the animal.
Fig. 3. Anterior antenna.
Fig. 4. Natatory foot.
Fig. 5. Second pair of antennæ.
Fig. 6. Oviferous foot.
Fig. 7. Tail.

Plate VII. *Fig.* 1. *C. Adamsi*, slightly magnified.
Fig. 2. Anterior antenna.
Fig. 3. Natatory foot.
Fig. 4. Oviferous foot: *a*. portion highly magnified; *b*. one of the spines highly magnified.
Fig. 5. Second pair of antennæ.
Fig. 6. First pair of jaws.
Fig. 7. Second pair of jaws.
Fig. 8. Mandibles?
Fig. 9. ——?

III.—*Observations on the Development of the* Medusæ. By John Reid, M.D., Fellow of the Royal College of Physicians of Edinburgh, and Chandos Professor of Anatomy and Medicine in the University of St. Andrews*.

[With two Plates.]

The following observations were made upon three colonies of the larvæ of a *Medusa*. One of these was procured on the 15th of

* These observations were laid before the Literary and Philosophical Society of St. Andrews at the Meetings of the 4th of May 1846 and the 5th of April 1847, and abstracts of them were printed in the 'Transactions' of the Society, and reprinted in Nos. 118 and 131 of the first series of this Journal.

September 1845, and the other two on the 11th of July 1846, adhering to the lower surface of stones in pools near low water mark. The stones were of a size which readily permitted them to be conveyed home, where I have kept them up to the present time. The mode I have followed in keeping these animals alive is this. The stones to which they adhere are placed in vessels of considerable size, supplied daily with water fresh from the ocean, and the animals fed once or twice weekly with small morsels of mussels, which they readily swallow. The first of the three colonies consisted of between thirty and forty individuals, and the largest was between two and three lines in length; the individuals composing the other two colonies were more numerous and of somewhat larger size.

After I had completed my examination of the structure of these animals I discovered that they had been described by Sars, first under the generic name of *Scyphistoma*, and afterwards as the larva of the *Medusa**.

Many of the larvæ increased much in size several months after I took them home, and the body of one that I measured was $\frac{1}{3}$rd of an inch in length and $\frac{1}{5}$th of an inch in diameter; another was $\frac{4}{12}$ths of an inch in length and $\frac{9}{12}$ths of an inch in circumference. As every part of their body is contractile, they can assume a great variety of forms. The more common of these are represented in Pl. V. figs. 1, 2, 3, 4 and 5. Though almost all of them are throughout of a grayish white colour, a few presented spots or patches of a purple colour, which were sometimes observed to disappear and reappear in the same individual. The tentacula are generally from twenty-two to twenty-seven in number, and when fully expanded are three or four times the length of the body. In one that I measured the body was $\frac{4}{24}$ths of an inch, and the tentacula $\frac{12}{24}$ths of an inch in length; in another the body was $\frac{2}{24}$ths, and the tentacula $\frac{8}{24}$ths of an inch in length. The mouth is very dilatable and varies much in shape, but is most commonly quadrangular. When fully expanded it forms a round aperture occupying nearly the whole of the disc (fig. 5); at other times its margins or lips are elongated and approximated so as to form a considerable quadrangular projection (fig. 2 *b*). Its more common condition perhaps is that represented in fig. 3 *a*.

The four round, equidistant and slight depressions placed between the mouth and margin of the disc are represented in fig. 2 *a*.

The body and tentacula of the larva are composed of two distinct layers, an internal and external. The internal layer chiefly consists of nuclei and nucleated cells (Pl. VI. fig. 19) of various sizes, some of them containing a large number of nuclei; while the external is chiefly composed of a structureless substance with

* Annales des Sciences Naturelles, tom. xvi. p. 321, 1841.

numerous minute nuclei disseminated through it. Numerous nearly elliptical and oval capsules (filiferous capsules), having a long thread or filament coiled up in the interior of each, are fixed upon the outer surface of the external layer, and in much smaller number upon the inner surface of the internal layer, where it lines the internal cavity or stomach. These capsules are most abundant upon the external surface of the tentacula. Fig. 20 is a highly enlarged view of a small portion of one of the tentacula, showing the filiferous capsules attached to its outer surface. These filiferous capsules vary much in size, but the largest are generally of a uniform size, nearly of an elliptical form, and about $\frac{1}{2000}$th of an inch in their largest diameter (Pl. V. fig. 8). Several of these, detached in examining portions of the larva under the microscope, had burst open at the smaller end, and the spiral thread projected through the opening and was uncoiled (fig. 9). In the entire capsule a rounded and narrow column passes from the smaller end, beyond which it slightly projects, in the direction of its longest diameter, nearly to its other extremity; and this column, to which the spiral thread is attached, protrudes from the interior of the capsule when it bursts. I have never observed these filaments projecting from the capsules when adhering to the surface of the body, unless when subjected to pressure, but it is difficult to use the more powerful object-glasses necessary for distinguishing these, without compressing more or less the part under examination.

The internal is considerably thicker and more opake than the external layer, is of a slightly yellowish colour when it accumulates at any point in greater abundance than usual, and is folded inwards to form the four equidistant projections seen on the surface of the stomach when the mouth is dilated (fig. 5 *a*), and when the body of the animal is slit open and then spread out (fig. 6 *c*). By making a transverse section of the body, the relative thickness of the internal and external layers, and the manner in which the internal is folded to form the four pouches or short canals that project from the internal surface, are very distinctly seen (fig. 7). These four short canals (fig. 7 *a*) terminate at their upper end in another canal, encircling the mouth and placed between it and the margin of the disc (fig. 6 *b*). Into this circular canal the hollow tentacula also open. The inner surface of the circular canal and the tentacula is lined by the internal layer. The four depressions (fig. 2 *a*) placed between the mouth and margin of the disc correspond to the termination of the four vertical in the circular canal. Across the bottom of these depressions, which at first sight look like apertures, a membrane is stretched sufficiently thin to permit readily of the transudation of fluids.

After reading Steenstrup's observations on the structure of

these animals*, where he describes four canals,—one in each angle of the extensible membrane surrounding the mouth and forming the lips,—passing from the circular canal already mentioned, and also another circular canal placed in the free margin of the lips, I repeated my examinations; and though I used glasses of very different magnifying powers, and made numerous trials, I could not satisfy myself of the existence of these canals. No doubt four equidistant white lines presenting the appearance of canals are seen, in certain conditions of the extensible lips, running in the positions indicated by Steenstrup; but in some of the numerous forms which the lips assume these lines entirely disappear, and when present they seem to be formed by narrow ridges on the external surface, resulting from the quadrangular shape assumed by the lips. The free margin of the lips frequently presented indications of the presence of a canal, but I could never satisfy myself of its actual existence. In making such investigations, it must be kept in mind, that the internal is readily separated by pressure from the external layer, otherwise we may be led into error. In the almost daily examinations I have made of these animals during the last two years, I never observed the slightest traces of the hollow quadrangular body described by Steenstrup as growing from the lower surface of the cavity or stomach in the body of the animal, sometimes projecting as high as the mouth, and placed in the middle of the stomach, like the clapper in a bell.

The inner surface of the lips and of the stomach, and the external surface of the tentacula and body, are covered with very fine cilia, so that currents of water, unless when the mouth is shut, are constantly passing in and out from the mouth and along the tentacula. The cilia upon the external surface of the body require the use of the higher object-glasses for their detection, and for a long time they escaped my notice.

The colony of larvæ first obtained began to produce buds and stolons about the middle of January 1846, and the other two colonies at the end of July of the same year. With intervals of comparative repose they have gone on reproducing abundantly ever since; so that, notwithstanding they are constantly suffering loss by death and other causes, the number of individuals in each colony has greatly increased. Whenever buds and stolons are formed, they commence by a thickening of the internal layer at those parts, causing a bulging outwards of the external layer. A single bud (fig. 10 *a*), occasionally two buds, grow from the upper surface of the stolon, and these become developed into larvæ in the manner described by Sars. The buds form upon

* On the Alternations of Generations, &c., translated for the Ray Society, pp. 22, 23.

all parts of the external surface, but most frequently near the lower part, of the body. On many of the larger larvæ several buds were seen growing at the same time (fig. 11 *a*). As a bud enlarges it becomes elongated and attenuated at its free extremity, and bends itself downwards to reach the surface of the stone to which the elongated extremity adheres: after this the attached end is gradually separated from the body of the parent. When thus detached, a small opening presents itself at its upper end, its interior gradually becomes hollowed out and cilia grow upon it, and tentacula commence to sprout around the mouth, exactly in the same manner as in the buds formed on the upper surface of the stolons. The outer surface of the buds is also covered with very fine cilia. Several of the buds were found lying loose at the bottom of the vessels in which the stones are kept, probably detached by accident, and these after a time fixed themselves to the surface of the vessels, and passed through their development into larvæ in the same manner as those that adhered for a longer time to the bodies of their parents. One of these detached buds fixed itself at two separate points, and two mouths, each furnished with its own tentacula, were formed at opposite ends of its upper surface. When a bud was developed on a stolon, the connecting part between the bud and the parent was more frequently absorbed, or at least disappeared, at other times the bond of connection remained; so that occasionally two, three or more larvæ of different or of nearly equal size might be seen growing closely united together at the base, as if one had split itself longitudinally into two or more separate individuals. This chiefly took place when the larvæ were so thickly clustered together that they had not room to spread sufficiently. When the buds were developed into young larvæ, these generally moved outwards from their parents to a small distance, leaving room for those that were to succeed them. This locomotion is generally slow,—one larva that I watched moved $\frac{6}{24}$ths of an inch in fourteen days,—and is effected by a sliding motion of the attached end over the substance to which it adheres. In this motion the attached end bulges outwards in the direction it is about to take (fig. 12 *a*), and the whole of this end gradually follows, carrying of course the whole of the upper part of the body along with it. More rarely they move more rapidly by pushing outwards a narrow prolongation similar to a long stolon (fig. 4 *a*), which becomes fixed at its further extremity, and the attached end becoming loosened, the whole body is carried onwards by the contraction of the prolonged part. The older larvæ are almost or entirely stationary.

The larvæ, when detached from the surface to which they are adherent, can again fix themselves. I have frequently performed

this experiment by placing those detached in separate vessels, and almost always successfully, when care was taken to disturb them as little as possible for three or four days, or longer. A considerable number of larvæ are adhering to the surface of the vessels in which the stones are kept *.

I made several experiments upon the reparative powers of the larvæ. In several the upper half of the body was cut off, and after three or four days its lower or cut end had closed in, and by the sixth day it had attached itself to the surface of the vessel, and shortly assumed all the appearances of an entire larva, sending out stolons and forming buds. Fig. 12 is a representation of the upper half of a larva eight days after it had been cut off. New tentacula, and a new mouth also, after several days presented themselves on the upper or cut end of the lower half. Several were divided longitudinally through their entire length, and when means were not taken to keep the cut edges apart they soon adhered again, and no traces of their division remained. In one divided longitudinally the two portions were kept apart, and in each the cut edges approximated and adhered, and two separate animals were thus produced from one.

The larvæ are voracious, and readily seize and swallow univalve or bivalve molluscans, or a crustacean, as large or even larger than their own bodies before they are stretched out, and after retaining them in the stomach, generally for about twenty-four hours in summer and nearly twice as long in winter, they reject them through the mouth. They also not unfrequently swallow one of their neighbours, and its sojourn in the stomach for some time terminates in its digestion and destruction. When they seize a univalve molluscan too large to be swallowed, they retain it firmly embraced in their tentacula, and insert their elongated mouth into the interior of the shell; and in like manner they keep dead articulate animals, or molluscans without shells, too large to be swallowed, in their tentacula for more than a day, and probably extract nourishment from them by acting on their textures by their extensible lips.

The larvæ of the first colony, obtained in September 1845, did not split transversely into young Medusæ in the spring of 1846, as I expected them to do, but continued to produce stolons and buds abundantly. A great number of them had then attained a large size, and many of them presented on their outer surface transverse rugæ, and four pretty deep equidistant vertical grooves, as represented in fig. 13, but none of them presented the appearances now

* According to Sars, "si on détache violemment ces polypes, il n'y a qu'un petit nombre qui peut se fixer de nouveau, et alors ils n'adhèrent pas si fortement qu'à l'ordinaire; la plupart restent libres au fond du verre."—*Opus cit.* p. 339.

about to be described, indicative of their splitting transversely into young Medusæ. In the beginning of February of the present year, the upper part of the body of some of the larvæ of the first colony became cylindrical, considerably elongated and much diminished in diameter, with thickly-set rings forming at the top. From the circumference of the rings first formed eight equidistant lobes or rays began to grow, the rings increased in size and became of a reddish brown colour, the tentacula gradually wasted away, and in the course of eight days the young Medusæ were beginning to detach themselves in the manner described by Sars. While this was going on at the upper part of the body, the process of elongation and the formation of new rings was proceeding downwards, as represented in Pl. VI. fig. 14, so that thirty or forty rings, each of which was about to become a young Medusa, could be counted on the body of one larva at the same time, and the body in some cases measured three-fourths of an inch in length. At this period the upper part of the body was of the form of an inverted pyramid, and had a distinctly reddish brown colour. As the grooves separating the rings increased in depth, it was observed that the body of the young Medusa above was at last attached only to the upper margin of the lips of the one below. Fig. 15 is a greatly enlarged representation of one of these young Medusæ immediately after it had separated itself from the body of a larva. A small proportion, probably not above one-sixth or one-seventh of the larvæ, underwent this process of splitting into young Medusæ, and in no case that I observed did it extend through the whole length of the body of the larva; for a portion, often very small, at its attached end did not become ringed (fig. 14 *a*), threw out new tentacula before the young Medusæ last formed were detached, and it continued to live as a larva. Some of the larvæ of the other two colonies obtained in July of the preceding year began to yield young Medusæ about the middle of March, and exactly in the same manner as in the first colony. A fortnight, or more, generally elapsed, after the commencement of the separation of the young Medusæ in a larva, before the process was finished.

The general appearance and habits of the young Medusæ immediately after they have detached themselves from the larvæ have been described already by Sars, but there are various parts of its structure which stand in need of additional elucidation. External to the quadrangular mouth occupying the centre of the lower surface of the body of the young Medusa (fig. 15) are four bifid hollow processes, placed at equal distances from each other, and adhering by the end of their undivided portion to the inner surface of the inferior wall of the stomach (fig. 15 *a*). The inferior wall of the stomach, which forms also the inferior surface

of the body, is so thin that at first sight these processes appear to be attached to the external surface. Fig. 16 is a greatly enlarged view of one of these bifid processes. Each of these processes forms two hollow floating tubes, communicating with the stomach or internal cavity by a common orifice (fig. 16 *a*), and having the edges of their external surfaces covered with numerous filiferous capsules (fig. 16 *b*). The stomach is large and extends nearly to the margin of the body or disc. Outside the position of the four bifid processes, and on the lower surface of the inferior wall of the body, there is a circular band, slightly elevated, more granular and opake than the portion of the body placed within it, having prolongations passing off from its outer edge to the intervals between the eight bifid lobes or rays that spring from the margin of the body, and others along the centre of the lower surface of these bifid lobes, as far as the ocellus placed at the point of bifurcation of each lobe (fig. 15). When the animal contracts the marginal lobes in swimming, this circle becomes narrower, more distinctly defined, and approaches nearer to the mouth. In certain states of the animal the prolongations from the outer edge of this circle to the intervals between the eight bifid rays are longer than represented in fig. 15. When the animal is examined in certain positions and with glasses of weak power, this circle, and the sixteen prolongations extending outwards from it to the intervals between the rays, and along the lower surface of the rays themselves, assume pretty nearly the appearances represented by Steenstrup as vessels; and as I have been unable to satisfy myself of the presence of any vessels there, I am inclined to believe that he has been misled in this way. I have occasionally observed the appearance of a thread-like nervous circle around the mouth, sending a filament along each of the rays towards the ocelli, on approaching which it bifurcated; but not having been able to make these out at other times, under circumstances that appeared favourable for their detection, I am not prepared to affirm that a nervous system is present.

At the point of bifurcation of each of the marginal lobes or rays there is placed, as Sars has described, a little eminence, hypothetically designated by Steenstrup an ocellus (figs. 15 *c* & 17 *a*). This ocellus forms a mammillary process, consisting of three distinct structures (fig. 17 *a*). The apex is chiefly formed of a considerable number of very minute crystals, and a small part of its base is more opake and more granular than its larger middle portion. From a greatly enlarged view of the crystals occupying the apex of the ocellus, given in fig. 18, it will be observed that the upper are shorter and thicker than the lower; in fact, while a few of the former are almost as thick as they are long, some of the latter are almost needle-shaped. On fixing the polarizing

apparatus to the microscope, it was observed that these crystals depolarized the light. I gave some of the young Medusæ to Principal Sir David Brewster for examination, and he returned me the following report: "The small raised portions of the Medusæ named ocelli consist each of six or more similar parts, each part having the property of depolarizing polarized light. When all the other portions of the animal are absolutely black, the ocelli shine with considerable brightness. Upon turning the Medusæ round in a plane perpendicular to the axis of vision, the individual parts of the ocelli disappear and reappear, according to the angle which their neutral axes (if they have double refraction), or their planes of separation (if they are merely polarizing laminæ), form with the plane of primitive polarization. If these raised portions named ocelli are really organs of vision, the probability is that their axis of vision is perpendicular to the general surface of the Medusa."

The inner half of the lower surface of the bifid portion of each of the marginal lobes (fig. 17) is thinned off to a sharp edge, bounded externally by a continuation of the ridge running along the middle of the inferior surface already described, so that the bifid portion resembles in form a pair of strong scissors.

A number of larger and smaller filiferous capsules, similar to those observed in the larvæ, adhere to the outer surface of the young Medusæ; and fine cilia are present on the inner surface of the lips and stomach, and on the outer surface of the four bifid processes floating in the stomach.

Though the normal number of the marginal lobes or rays is eight, yet occasionally they were as few as four and as many as twelve. In a few cases one or more of these lobes were trifid, with an ocellus placed in the cleft of each division.

I was not able to preserve the young Medusæ alive more than twenty days. During that time the lobes or rays had become shorter from the expansion of the body, and in a few, small papillæ were forming in the clefts between the lobes.

A comparison between the observations of Sars and Steenstrup upon the larvæ of the Medusa living in the ocean, and those made upon them while living in the artificial condition described, elicits some facts of considerable interest. According to Sars and Steenstrup, the colonies of these animals living in the ocean split up entirely into young Medusæ each spring, and completely disappear, and new ones are founded in September from the ova of the adult Medusæ; but while living in the artificial state, as was also some years ago remarked by Sir John Dalyell *, a certain number only of the individuals of the colony

* Jamieson's Philosophical Journal for 1836.

undergo this process, and that not throughout their entire length; for even a portion of each of those that form young Medusæ by transverse divisions of their substance, continues to live as a larva. The first colony I obtained was seventeen months in my possession before any of the individuals composing it underwent its development into young Medusæ. That the larvæ, even when living in the ocean, are not always formed in autumn and undergo their development into young Medusæ in spring, is evident from the fact, that two of the colonies in my possession were obtained from the ocean in July. Whether these larvæ had been generated the preceding autumn, and continued to live as such up to the time they were obtained from the ocean, or had been generated at some period subsequent to this, it is impossible to determine.

Account of a new Actinia.

Though the *Actinia* I am about to describe has in many respects a close resemblance to the *Actinia chrysanthellum* of Mr. Peach, described and figured in Dr. Johnston's late edition of his work on 'British Zoophytes,' vol. i. p. 220, it yet differs from it sufficiently, at least as far as I can make out, to justify me in regarding it as a distinct species. If this should be confirmed, I would propose to name it *Actinia cylindrica*.

Body elongated, cylindrical, free; tentacula uniserial, submarginal; mouth elongated upwards, forming a conical tube with small processes attached to its margin.

This animal was found in St. Andrew's Bay, by Mrs. Macdonald and myself about two years ago, immediately after it had been thrown ashore during a storm, and it was kept alive for three days. Fig. 21 (Plate VI.) is a representation of the form of the animal of the natural size.

The body is cylindrical and marked by longitudinal lines. The inferior fourth of the body is translucent, more contractile than the upper part, and sometimes assumes nearly a conical form with the apex downwards. The upper three-fourths of the body are opake and of a faint pink colour. The tentacula are twelve in number, ranged in a single row, smooth on the surface, of a light pink colour, and having their internal or oral surface crossed by four zigzag white lines (fig. 22). They are elongated transversely or flattened from within outwards, and taper towards their free extremity. They were never seen more elongated than what is represented in fig. 21, but as the animal appeared to be languid, it is quite possible they are capable of greater elongation. When contracted to the utmost they formed little conical eminences, projecting outwards and upwards, and were seen to be attached immediately below the outer margin of the disc. Twelve

bands of a faint reddish brown colour and adhering along their edges, radiate inwards from the circumference of the disc, converge at its centre, and prolong themselves upwards to form the mouth, or rather the lips. The margin of the lips is surrounded by twelve small processes, six of which are very minute; these processes are of a triangular form and of an orange colour, except at the edges, which are translucent. This prolonged mouth did not always occupy the centre of the disc, but could be directed towards any part of the margin.

The external sac sent strong partitions inwards, the position of which was marked by the longitudinal lines on its outer surface, and in the interstices of these partitions the ovaries were placed. This animal in many respects closely resembles the *Iluanthos Scoticus* of Professor E. Forbes*, and the chief difference between them is found in the structure of the mouth.

EXPLANATION OF PLATES V. and VI.

Plate V.

Figs. 1, 2, 3, 4 and 5. Representations of the more common forms assumed by the larvæ.

Fig. 6. A larva slit open and stretched out to show the four vertical canals, and the manner in which they terminate in the circular canal: *a*, extensible lips; *b*, circular canal; *c*, four vertical canals; *d*, tentacula considerably shortened by their contraction.

Fig. 7. Transverse section of the body of a larva to show the manner in which the four vertical canals are formed: *a*, vertical canals.

Fig. 8. Filiferous capsule entire.

Fig. 9. Filiferous capsule burst and the spiral filament uncoiled.

Fig. 10. Larva throwing out stolons, from one of which a bud is springing.

Fig. 11. Larva having several buds growing from its surface.

Fig. 12. Upper half of a larva eight days after it had been cut across.

Fig. 13. One of the forms assumed by some of the larvæ.

Plate VI.

Fig. 14. Larva in the process of splitting into young Medusæ.

Fig. 15. Lower surface of one of the young Medusæ after its separation from a larva: *a*, one of the four bifid processes in the stomach; *c*, ocellus.

Fig. 16. Greatly enlarged view of one of the bifid processes in the stomach.

Fig. 17. Greatly enlarged view of one of the eight marginal rays or lobes: *a*, ocellus.

Fig. 18. Greatly enlarged view of the crystals in apex of ocellus.

Fig. 19. Two of the nucleated cells and several of the nuclei that enter so abundantly into the structure of the internal layer, as seen when a portion of this layer is detached.

Fig. 20. Small portion of a tentaculum, highly magnified, to exhibit the filiferous capsules adhering to its outer surface.

Fig. 21. Representation of *Actinia cylindrica* of the natural size.

Fig. 22. Oral surface of one of the tentacula.

In the examination of the more minute structures figured above, a one-eighth of an inch object-glass made by Powell and Leland, and a one-fourth of an inch object-glass by Smith and Beck, were employed.

* Annals of Natural History, vol. v. p. 180.

IV.—*On the* Ventriculidæ *of the Chalk; their classification.* By J. Toulmin Smith, Esq.

[Continued from vol. xx. 1st Series, p. 191.]

I have thus described with some detail the structure which marks a large group of fossils from the chalk, and have further endeavoured to show what are the natural affinities of the group thus marked. The only clue has thus been obtained towards arranging, in a true and natural classification, those widely varied forms to which, under various secondary modifications, this structure belongs. The few of these which have hitherto been known have been uncharacterized except by names as various as the different writers, and which, being names merely, could leave no impression of reality on the mind of the inquirer.

It will assist the inquirer, and will much enhance the importance of the present investigation, if, before entering on the description of their modifications, something is said of the stratigraphical distribution of these fossils.

From what has already been stated, it will be obvious that these fossils require to be *sought*: they can seldom fall in the collector's way as do fossils having solid parts, Testacea, Vertebrata, &c. If found at all in the hands of the dealer they will usually be fragmentary only, or in a matrix, the flint, the deceptive character of whose obvious appearances has been already shown. By far the greater part of the forms assumed are, besides, such that no blow of the hammer can disclose the character of the fossil.

It is necessary to premise thus much that it may be understood that the fact of these fossils not having yet been recognized in particular localities or strata is no proof that they do not exist therein; and, now that the true structure characteristic of them has been described, it may be hoped that the presence of some representatives of the family may be detected much more widely than has been hitherto suspected. A mere fragment may now serve for the detection of that presence*.

As far as can be gathered from the various authorities already cited, it would appear that these fossils are more abundant in England than in any other country. In the chalk of Kent, Sussex, Norfolk, Wiltshire, and the respectively adjoining localities, some of the forms are abundant, though in each region the localities in which they abound are certainly restricted. In the chalk of Yorkshire they appear to be much less abundant. Indeed many bodies which have heretofore been grouped as *Ventriculidæ* from that region have no relation to that family; while

* Of course not for the determination of species, or, necessarily, even of genus.

the forms hitherto collected there of true *Ventriculidæ* are very rare, if we may judge from the specimens in the museum of the Yorkshire Philosophical Institution, for the opportunity of carefully inspecting which specimens I am indebted to the courtesy of Mr. Charlesworth*. In England these fossils have not hitherto been recognized in any other than the Cretaceous group. It is probable that careful search will reveal them throughout all the members of that group. At present they have been found in five divisions of it; viz. the Upper Chalk, the Middle Chalk, the Lower Chalk, the Chalk Marl, and the Upper Greensand. The prevalence indeed of certain forms is characteristic of certain of these divisions†; a result which unexpectedly displayed itself after the classification presently to be exhibited had been worked out from a cautious study of the individuals, and the value of which result must therefore strike every inquirer. The particular divisions characterized by the predominance of one or the other class of forms will be shown in severally describing those forms.

There is no *à priori* reason why representatives of these forms should not be found in older and in newer formations than these cretaceous beds. Still the fact of their not having been thus found in England, where, in those cretaceous beds, some of them so much abound, leads to some hesitation in relying implicitly on the alleged much lower stratigraphical position of some foreign forms. The foreign forms from the true chalk appear to be few and rare; but there are several figures in Goldfuss, to some of which I have already alluded‡, probably representing forms belonging to this family, which are there given as from the "Jurakalk." In the

* In addition to the acknowledgements which I have already made, I have the further pleasure of now recording the kindness, in affording me the means of examining different specimens from very various localities, of Mr. Lyell, Mr. Wetherell and Mr. Oakeshott of Highgate, Mr. Cunnington of Devizes, Mr. Catt of Brighton, and Mr. Whittle of St. John's College, Cambridge, besides that of Mr. Charlesworth as above-mentioned. I must also acknowledge the kind assistance afforded me by Mr. Waterhouse of the British Museum, in facilitating the task of inspecting the specimens in that collection. To the President of the Geological Society I am also indebted for the prompt courtesy with which he has enabled me to avail myself efficiently of illustrations from the valuable museum of that Society. I would take this opportunity of saying that I shall be greatly obliged by any illustrations and opportunities similar to those which have already been so kindly and liberally afforded to me.

† See observations in the Ann. and Mag. of Nat. Hist. vol. xx. p. 337. An interest beyond even that which they are calculated intrinsically to excite is thus given to these fossils, of the same nature as that which attaches to a series of Ammonites from different beds.

‡ *Ante*, vol. xx. p. 78. It is proper to state that there are many forms, besides those thus specified, figured by Goldfuss as from the Jurakalk, and which I have not much doubt are Ventriculidæ. I have only enumerated the more obvious.

British Museum, again, is a large and valuable series of fossils, which I have carefully examined, and which I can therefore state with assured confidence to belong to this family*, and which are stated to be from Mount Rhanden in Switzerland; a locality the strata of which are declared to be equivalent to the lower beds of the Middle Oolite of England. The matrix *appears* much the same as that of our English chalk marl; but that test is, of course, very incomplete. The point requires careful investigation; and, as the true character and importance of these fossils will have now become known, it may be hoped that the attention of some of the many competent foreign observers may be directed to it. As I shall show the changes which these forms have undergone in passing from one division of our English strata to another to have been great, it will be peculiarly interesting to ascertain exactly to what strata these foreign forms do actually belong; for many of them differ much from our English forms. It is interesting at present to remark that the form which is of the greatest vertical range in the English beds (*Brachiolites digitatus*) is unequivocally found in these Rhanden beds.

In p. 510 of the first volume of the Journal of the Geological Society there is described by Mr. Lonsdale, under the name of "*Ocellaria ramosa*," a fossil found by Mr. Lyell in the Eocene deposits at Jacksonborough in Georgia, United States. Did this fossil exhibit any true affinities with the group which has been called *Ocellaria* it would necessarily belong to the Ventriculidæ, and I was anxious to ascertain the facts. Mr. Lyell has obligingly enabled me to do this by placing in my hands all the specimens found by him, and which are, it is believed, all that have ever been found. The result is, that the fossil is found to present none whatever of the characters of *Ocellaria*; and I cannot understand upon what grounds it has had this name affixed to it by Mr. Lonsdale, except that he appears, from his observations, never to have had an opportunity of examining any actual specimens of the so-called *Ocellaria*, and to have been misled by some of the figures†. These fossils however answer to no part of the generic description given by Ramond, or any subsequent writer, of the *Ocellaria*. The tubules in the Eocene fossils are tubules ramifying through a massive substance, and there is not any polyparium which is "*explanato-membranaceum*," and "utro-

* These treasures are at present unarranged. I should be happy to assist in that task, and to complete it by adding, as far as possible from my private collection, all the British forms, should the present Commission result in any prospect of improvement in that respect.

† The figure specially referred to, and which is copied by Lamouroux, pl. 72, fig. 5, has certainly a considerable resemblance to a special fractured surface of the Eocene fossil.

que latere porosum." The characters of *Ocellaria*, as given by all the authors*, are clear and unmistakeable so far as they go; and there cannot be a moment's doubt as to what the true relations of the so-called genus are, as will presently be seen. It is perfectly certain that this so-called *Ocellaria ramosa*† has none of these relations, and therefore that it does not serve to bring the Ventriculidæ within the tertiary period. No trace of this family has, then, yet been anywhere discovered higher than the upper beds of the English chalk.

As it is desirable to have the treatment of the subject as complete as possible, so far as it goes, and as the materials which I have collected from the English chalk are sufficiently abundant to lead me to hope that such completeness may be given, for all practical purposes, to the description of the forms found in those beds, I shall confine myself at present to these last; which I the rather do in that, while it would be *à priori* probable that the examination of so extensive a series of beds would at any rate afford a full series of typical characters,—and therefore a sound basis for a permanent and generally applicable system of classification,—the examination of the Rhanden specimens in the British Museum has satisfied me that all of them will range within the typical groups which the forms of the English chalk have led me to assign.

I have already indicated‡ in what direction we must look for the essential characters which mark this whole family. It is extremely improbable that a structure so extraordinary, so peculiarly bearing the marks of special design and adaptation as the octahedral structure, should be otherwise than characteristic of the family in individuals of which its existence has been discovered. Until, then, it has been found elsewhere, the philosophical inquirer will take that structure as his guide in the deter-

* Those characters are, "Polypier pierreux, *aplati en membrane*, diversement contourné, subinfundibuliformée, à superficie arénacée, muni de pores sur les deux faces." The observations of Milne-Edwards, on an inspection of the actual fossils, are alone sufficient to show that the present fossils could not be *Ocellariæ*, their apparent tubules being, as stated in p. 511, sometimes penetrated by fibres in a radiated manner. Milne-Edwards expressly says (Lamarck, Anim. sans Vert. ii. p. 291), "L'axe *solide*, qui remplit assez ordinairement les trous, et qui a été pris pour une partie du Polypier lui-même, n'est que la gangue qui s'est moulée dans ces trous, et qui s'est cassée au niveau de la surface du Polypier, lorsque celui-ci a été détaché de la masse qui le renfermait."

† The fossil is however a very curious and interesting one. Its whole aspect and character recall those of the Alcyonium, both in its massiveness, its cylindrical tubules, and their connecting plexus of fibres. I have many analogous fossils from the chalk, into the investigation of which it is my intention to enter when the present subject shall be completed.

‡ *Ante*, vol. xx. p. 182.

mination of the members of this family. My careful attention has therefore been directed to ascertaining the presence of that structure under every various mask of external form, and I have hitherto invariably found that presence accompanied by certain other characteristics, which would necessarily be present if the affinities which I have already attempted to show are those of the Ventriculidæ be the true ones. Without full confidence in the Law of Unity as a sure guide, I cannot conceive of any progress being made in any scientific investigation. I have not found that guide to fail me yet in the present investigation, and am therefore content to take it as the basis of such exposition as I am now able to give of the genera and species of the family Ventriculidæ.

Proceeding therefore on this basis, it may be stated generally, that all those fossils which are marked by a membranous structure made up of cubic squares, with equally subtending octahedral fibre at the angles of union of those squares, belong to the family Ventriculidæ, and that all members of that family are marked by that structure. We shall find, it is true, thus associated forms externally most diverse*, and the alleged affinity of which would at first sight startle the inquirer; which have indeed hitherto had places the most different assigned to them: but I shall be able to show that other and most interesting Unities prevail through all these various forms in addition to that structural one; and these diversities will thus become only another useful addition to the often repeated but too often neglected lesson, that no guide is more fallacious than likeness or unlikeness of mere external form†.

"A natural classification," says Milne-Edwards, "is nothing else than a description of the modifications, more or less important, observed in the structure of animals, and a specification of the differing degrees of likeness or unlikeness which the latter bear to each other‡." Nothing is easier than the multiplication of genera and species. But it is no slight task, though a most important one, to determine what are the material modifications on which distinction of genus should be founded; what the ma-

* On the other hand, I shall take a future opportunity of showing that forms externally bearing much resemblance to the Ventriculidæ have in truth a very different structure and affinities.

† Parkinson long ago remarked, that "if the *figure* of the fossil be assumed as the leading character of the species, substances, differing materially in their structure, will be classed together in the same species; and, on the other hand, if the species be formed on the external *structure*, we shall have under the same species substances differing widely in their forms." Vol. ii. p. 128. It would have been well if Goldfuss and others had paid a little attention to these important truths.

‡ Sur les Crisies, &c., p. 233.

terial points of likeness or unlikeness which should mark separate species*.

The only principle upon which I can understand any philosophical or natural classification to be founded, is the taking some principal and most easily recognizable point in the œconomy of the living animal, and examining all the individuals under review in reference to that one point.

It has been already seen that the Ventriculidæ belong to a high type of the Molluscan Polyps,—to the Polyzoa,—approaching most nearly to the recent *Eschara* and *Halodactylus*. The fossilized remains of animals of this order, the organization of whose recent congeners has been but so lately understood, might seem at first sight to baffle any attempt to seize on such a point. It seems to me however that such a one may be found. In all recent animals of this order the first essential to their life and well-being is the presence and free access of the sea-water. Various contrivances are adopted to secure this end,—some genera and species being parasitical, some loosely floating, some stiffly erect; each, varying as they also do in form, adapted to the peculiar circumstances of the locality which it inhabits, and each, according to the particular plan adopted, exhibiting some characteristic differences in habit and organs. This is precisely consistent with the observations already made† as to the constant relation existing between the polypidom, *rightly examined*, and the nature of the inhabiting polyps. Such differences no doubt existed in the recent Ventriculidæ; and though it is obviously impossible that we should ever be able, in these fossils, to ascertain the points of difference in habits and individual organs, we may, by care and patience, ascertain those differences in the contrivances displayed in the structure of the polypidoms which we must thus be satisfied were intimately and necessarily connected with such differences in habits and individual organs. I allude to the various modes of folding of the delicate membrane‡ which forms the framework of every individual of this family, and on whose surface the minute and numberless colony of polyps dwelt. I ap-

* Were I to follow the example of some botanists, who, for example, in a favourite tribe, the *Cactus*, have amused themselves with hair-splitting of genera to a marvellous extent, I might readily succeed in perplexing the inquirer with a great multitude of unintelligible names. Between many of the species which I have grouped together, differences far more marked exist than those by which these gentlemen—and too many palæontologists—have overlaid the intelligibility of their classifications as *generic* distinctions.

† *Ante*, vol. xx. p. 177–179.

‡ A membrane, it will be remembered, which, by its structure, was firm like the *Eschara* (though not calcareous), and not loosely floating like the *Halodactylus*. This is important in considering the permanence of the different modes of folding adopted.

prehend that it can need no detail of argument or mathematical demonstration to show, that upon the mode and degree of folding of this membrane, the greater or less freedom of access, change, and circulation of the water, and its consequent power of being acted upon by the numerous ciliated tentacles and moveable processes, must have depended. Every one who is familiar with the difference in mere circulation of air between the narrow street and the open road, between the deep valley and the hill top, will recognise the essential importance in this respect of every difference in that mode and degree of folding; and, when the extreme minuteness of the individuals is considered, it will appear that variations of fold hardly appreciable to the eye will have probably had a material influence on the condition of the tenants of these wonderful structures. I cannot doubt that every *constant* difference in the mode and degree of folding of the Ventriculitic membrane was accompanied by some modification in the organs or habits of the animals, adapting them to that particular mode and degree of access, change, and circulation of sea-water which that mode and degree of folding made a matter of absolute necessity*.

Taking then the Ventriculidæ as a family of the *Polyzoa*, I shall first endeavour to show that there are certain broad and very marked constant modifications in the mode of folding† characterizing certain extensive groups which yet have many points of constant difference between the individuals which, as groups, are respectively thus characterized. These groups will form distinct genera. I shall show that certain subordinate but yet important modifications mark, in common, several of the individuals of each of these genera, which individuals yet have further still subordinate but constant and therefore characteristic points

* Sir J. G. Dalyell, in his recent work on 'Remarkable Animals of Scotland,' especially notices the importance of attention to the *varying* condition of the water in which specimens are kept as the great secret of their preservation; and even his care has often failed. A "low organization" and slight sensibility have been hastily attributed to Polyzoa from their enduring great changes of heat and cold. There is no animal capable of enduring greater changes in this respect than man. But take another class, and it is well-known that from the same heap of frozen fish one may be dashed to shivers on the ground, while another, put into a pail of water, will, in two minutes, be swimming about.

† The inquirer will at once perceive the difference between this and mere external form. The same general external form may mask numberless most different modes of folding. My object is to aid in realizing, by classification, the living animal in all its integrity and varieties. By the accumulated names *Scyphia, Coscinopora, Guettardia*, &c., nothing ever was or can be vivified; no real idea conveyed to the mind. But the object of the naturalist should surely be, not an accumulation of mere *names*, but the realization of living and true ideas of various absolute modes of actual existence, be they past or present.

of difference. The inquirer is thus further relieved from the detail of specific differences by the division of each genus into sections. The still subordinate but constant points of difference last named will be characteristic of species.

I have already alluded to the important and valuable test of the soundness of these principles of classification afforded, unexpectedly and after the work was completed, by the stratigraphical harmony exhibited by the table of classification. It will be sufficiently obvious that the ocean of different ages would have such modifications as would not be adapted equally to all varieties. We accordingly find among the Ventriculidæ, as in other divisions of palæontology, a few species enduring through many changes; others dying out; while with every fresh æra fresh forms display themselves.

It will be understood from this, that mere *size* does not enter as an element into the determination of genus or species. Of many species I have specimens from an inch to eight or nine inches in diameter. It is not necessary to enter very fully, therefore, into the question of *growth*. That question, always a difficult one in palæontology, is difficult even in recent forms of the families allied to the Ventriculidæ. It would be vain to hope to throw much light upon it by fossil forms. Where *constant* differences are found under all varieties of size, we are bound to consider them as distinct species. I shall touch briefly on the question of growth in introducing each separate genus.

It will be also understood that the mere external (outward or inward) general *form* of the fossil does not enter as an element into the determination of genus or species. I have shown how deceptive that criterion must ever be. In the present instance the same general external form conceals essential differences in the mode and degree of folding of the membrane.

It will occur to the reader that to follow the fold of a membrane, the trace of which is preserved only in a hard and solid matrix, must be a work of great difficulty; and especially when that matrix is either so friable as the chalk, or so impracticable as the flint. The actual amount of the difficulty* cannot however be fully appreciated without actual experiment. The presence of that very oxide of iron, without which the forms could not be, in general,

* In order that the actual nature, importance, and results of the present investigation should be properly understood, it is necessary to remind the reader that from the time of Dr. Mantell's first work to his latest, and either by him or the other latest writers (see Portlock's 'Report, &c.' p. 342), it has never been suggested or suspected that *any membrane whatever existed* in any of the Ventriculidæ. They all describe them as composed of anastomosing "*cylindrical fibres*," (see *ante*, vol. xx. p. 76,) between which, on the inside, papillæ or tubuli arise. I have demonstrated that the basis of the Ventriculidæ is a simple unperforated membrane; that, therefore, the

even detected, necessarily stains the matrix beyond the structure itself; and it requires the nicest and most painful discrimination to determine what is due to structure and what to mere iron stain. Feeling however that such a course of investigation could furnish the only true materials of a natural classification, I have endeavoured to overcome these difficulties. And it may save the task both of making and answering many objections if I now state that I have, with this object, dissected with elaborate care numberless specimens, in addition to many hundreds of sections of specimens both in flint and chalk, which, with the like purpose, I have made. There is not one species which I have established which I have not determined from actual and personal section of specimens either in chalk or flint, usually both, and in which, with scarcely an exception, I have not followed and traced out the actual fold with the knife and needle.

My aim has been to present such a classification and nomenclature as should be intelligible and at the same time expressive; which, whether respect be had to genus, section, or species, should give some accurate and specific idea of the point on which the respective division has been founded; that thus a mere inspection of the table of classification may carry with it some real and true ideas as to the objects included*. The name

descriptions so long before the world, and so often repeated, are fundamentally erroneous,—the conclusions as to the œconomy of the animal being necessarily, therefore, as fundamentally erroneous. It is upon the same laborious care which has enabled me to demonstrate these facts, that I rely in attempting the descriptions now to be given of the different *modes of folding* assumed by that membrane, and the superficial appearances of which have misled these observers.

* It is usually unadvisable to alter names once applied; but where the character of an object has been wholly misunderstood, not even its generic or structural character having been known (see the last note), there can be no claim to retain old names. Their retention is then generally mischievous as a mere perpetuation of error. I fully agree with Dr. Farre (*ut ante*, p. 405, note) that oftentimes "confusion and doubt (in nomenclature) can only be dispelled by beginning *de novo*," and so applying new names in harmony with a system founded in nature and upon some definite principle. I think it better to give here all the names which occur in Mr. Morris's Catalogue whose objects appear to belong to the Ventriculidæ,—a list which will, moreover, show the "confusion and doubt" which have hitherto prevailed in the nomenclature of this family.

Names in Morris's Catalogue.	*In the following classification.*
Choanites flexuosus	Ventriculites latiplicatus.
Choanites subrotundus	Cephalites constrictus.
Ventriculites alcyonides [Ocellaria]	Ventriculites quincuncialis.
—— alternans	Probably V. bicomplicatus.
—— Bennettiæ	One of the Cephalites annulati, but no accurate description; and the figures of Michelin and Mantell totally differ.

applied to the whole family and to the first genus is the only apparent exception to this rule*. The name *Ventriculites* would certainly not have been applied to any of these bodies, or to the family, by myself. It was applied by Dr. Mantell to the few forms found by him, under the idea of the internal cavity being the true digestive surface of a single animal. Though the idea under which the name was thus applied has been shown to be wholly erroneous, I have been unwilling, out of respect to the many labours of Dr. Mantell in the field of palæontology, to reject, as others have done without assigning any reason, this generic appellation; and I have justified myself in its retention by the classical use of the same word, though in a secondary sense only, in a very different way, viz. as applied to mere sacciform cavities†. It will be understood, therefore, that the terms *Ventriculidæ* and *Ventriculites* bear no reference to any *digestive* cavity, but simply to the fact of the creatures to which they are applied always assuming forms which display a central cavity more or less simple. I am glad that this modification in the meaning of the word enables me to retain a name which will always bring to the inquirer's recollection the long and successful labours of Dr. Mantell.

It is impossible to examine an extensive series of remains exhibiting the characteristic structure of the Ventriculidæ, without perceiving that, however widely in other respects the individuals differ from one another in the mode of fold of their membrane, they all range themselves within one or the other of three strongly marked and constant modifications, quite independent of mere size.

The first in natural order, as having most of that simple *pouch* form which is implied in the name *Ventriculidæ* as above ex-

Names in Morris's Catalogue.	*In the following classification.*
Ventriculites infundibuliformis	Ventriculites cavatus or bicomplicatus.
—— quadrangularis	Brachiolites angularis.
—— quadratus	? not a Ventriculid.
—— radiatus	Ventriculites radiatus.
Ocellaria inclusa	—— quincuncialis.
—— nuda	Ibid.
Spongites Townsendi	Ventriculites simplex.
—— labyrinthica	Brachiolites convolutus.
Scyphia Fittoni	Fragment of Brachiolites digitatus.

* The termination "*ites*" is not in itself very classical, but has been so generally employed as to be a convenient and intelligible distinctive mark of *fossil* generic appellation. Hence I retain it in "*Ventriculites*," and am therefore obliged so to terminate the other generic names. I am glad to be able to retain, consistently, Dr. Mantell's specific name *radiatus*.

† Thus Cicero: "Ex ea [anima] pars concipitur cordis parte quadam, quam *ventriculum* cordis appellant, cui similis alter adjunctus est in quem sanguis a jecore per venam illam cavam influit."—*De Nat. Deor.* ii. § 55.

plained, are a large number whose general form is that of a more or less open or close sac, the wall of which rounds or thins off to a marginal edge. All of this kind are single, and supported on a single root, unless in those few abnormal cases before mentioned*, and which afford no exception to the principle either of the structure or classification. Where, as very rarely occurs, two are united, it is at the roots that they are united. They are not branches of one body.

All these forms I distinguish by the name of VENTRICULITES.

Next to these are naturally placed another group, all the members of which are much rarer than the last, most of them of great rarity, but yet exhibiting a diversity of forms as great, well-marked and constant as the different individuals of the genus *Ventriculites*. All however are marked by the very striking peculiarity of the wall of the pouch not thinning or rounding off to a marginal edge, but being crowned by a broad and distinct head, prominent and well-defined, and totally differing in aspect, structure, and function from the rest of the body. This characteristic suggests, as peculiarly appropriate, the generic appellation of CEPHALITES.

The two genera thus distinguished each exhibit, though with striking modifications, more or less of the simple pouch form in their internal cavity, or of obvious singleness in the general shape which the fold of the wall of their cavities, or their apolypous head, assumes; but a large group remains to which neither character applies, and all the members of which stand out conspicuously as folded in many lobes and in many broadly separated parts. The word *brachium* being often used by the best authors in the sense of projection simply, I use the diminutive of that word to distinguish all of this group by the name of BRACHIOLITES.

But, again, the individuals comprised within the description of the genus *Ventriculites* are found to exhibit two broad modifications in the general aspect of the membrane composing the wall of the pouch. The two sides of the wall correspond in the one group, both surfaces being either smooth, or, if marked with folds, the depression of one side having a corresponding elevation on the other; in the other this correspondence is absent, owing to some change in the direction of the fold before reaching the opposite surface, as already alluded to†. It will materially assist the memory and researches of the inquirer if we accordingly divide the genus *Ventriculites* into two sections, which I distinguish by the names *Simplices* for those species having corresponding surfaces, *Complicati* for those which change the direction of their fold between the two surfaces.

* *Ante*, vol. xx. p. 90. † *Ante*, vol. xx. p. 88.

So the individuals comprised within the description of the genus *Cephalites* exhibit two broadly-marked modifications; the head of the one group being only of the same breadth as the thickness of the wall, and being placed exactly at the top of that wall, and nearly at right angles, at every point, to the outer and inner surfaces of that wall; the head of the other group being much broader than the thickness of any part of the wall, and never lying flat at the top, but extending more or less down over the sides of the wall. These marked differences are accompanied by important differences in the mode of fold of the membrane. I distinguish therefore the genus *Cephalites* into the two sections *Annulati*, being those in which the head extends as a mere broad ring round the flat top of the wall, and *Dilatati*, being those in which it is spread out so much more extensively.

And so also the members of the genus *Brachiolites* are at once separated into two groups, by the remarkable circumstance that some of them have the extremities of those projecting lobes into which they are divided *open*, others *closed*. The latter I distinguish as the sectional division *Operti*, the former as *Aperti*.

I shall hereafter point out the minor modifications accompanying these more striking ones, and endeavour to show the final purposes of the respective modifications themselves.

It will of course be well understood that, as in every class of fossil forms the exact determination of the species of individual specimens is often difficult, frequently impossible, such must sometimes be the case with respect to the Ventriculidæ. The conditions under which they are found render them peculiarly liable to this difficulty; and the inexperienced observer who has not yet learned to distinguish that which is a mere *cast** from a specimen in which some of the actual body is preserved,—a task of no slight difficulty, and only to be successfully undertaken after acquiring a full knowledge of structure,—will often find himself baffled in the attempt at specific identification. Hence the importance of attention to those sectional and generic characters already noticed, and which he will rarely be unable to distinguish.

These broad modifications, and the respective relations thereto

* Michelin's *Ocellaria grandipora*, pl. 40. 3 *a* & 3 *b*, is a mere *cast* of external and internal surfaces. The imperfection and indefiniteness of almost all the figures yet published have been already noticed (*ante*, vol. xx. p. 78–80). It would therefore be a useless attempt to endeavour to identify them. Objects of this class require to be well understood before they can be truthfully represented by figures. The figures of Dr. Mantell are no exception to this remark, as they only give the broad external characters of one species (which they however do) without any indication of the mode of fold of the membrane which gives rise to those characters, and the very existence of which membrane Dr. Mantell denies.

of the minor modifications, will be the better understood from the following table of classification, in which I have arranged the species belonging to each genus in such relative position as should best display the transition from one general character of folding to another, and thus gradually realize the true relations existing between the very different forms which lie at the two extremes.

Class MOLLUSCA TUNICATA *.

Order Polyzoa †.

Family Ventriculidæ.

Ventriculites, *Mant.*

§ *a.* Simplices.

1. simplex.
2. impressus.
3. quincuncialis.
4. muricatus.
5. tessellatus.
6. cavatus.
7. striatus.

§ *b.* Complicati.

1. mammillaris.
2. latiplicatus.
3. decurrens.
   Var. tenuiplicatus.
4. radiatus, *Mantell.*
5. bicomplicatus.

Cephalites.

§ *a.* Annulati.

1. longitudinalis.
2. guttatus.
3. paradoxus.
4. alternans.
5. bullatus.
6. retrusus.
7. catenifer.
   Var. annulatus.
8. compressus.

§ *b.* Dilatati.

1. capitatus.
2. campanulatus.
3. constrictus.
4. perforatus.

Brachiolites.

§ *a.* Operti.

1. tuberosus.
2. elegans.
3. convolutus.
4. angularis.

§ *b.* Aperti.

1. foliaceus.
2. racemosus.
3. digitatus.
4. tubulatus.
5. fenestratus.
6. labrosus.
7. protensus.

* It is quite beyond my present purpose to discuss the exact position of the Polyzoa. The main truth of Professor E. Forbes's opinion is however so generally recognized, that I am justified in the above designation of *class*, which must always be felt to be an important element in giving vitality to a classification. Professor Forbes says, "The anatomical structure of the Ascidioida or Bryozoa removes them altogether from the class of Zoophyta into that of Mollusca, where they should form an order of Mollusca tunicata parallel with the group of compound Tunicata of which *Botryllus* and such forms are examples."—Ann. and Mag. of Nat. Hist. vol. xiv. p. 390. See Owen's Lect. on Comp. Anat. I. pp. 100 and 269, 270; Van Beneden, Recherches sur les Bryozaires, p. 37; Johnston's British Zoophytes, p. 2. (See also Thompson and Farre.) The actual and important distinctions are noticed by the last writer, p. 256; and the vast superiority in vital activity of the Polyzoa to the Ascidians, is well pointed out by Sir J. G. Dalyell (*ut ante*) pp. 229, 230. I have heretofore used the general term "zoophytes" in conformity, as already intimated (vol. xx. p. 190), to what is at present the ordinary language of authors, and a departure from which would, therefore, have caused ambiguity and unnecessary confusion.

† *Thompson*; Bryozoa, *Ehrenberg*; Ciliobrachiata, *Farre.*

[To be continued.]

V.—*Reports on the Progress of Physiological Botany.* No. 1. By Arthur Henfrey, F.L.S. &c.

Recent researches into the origin and development of the Vegetable Embryo.

This "vexed question," on which botanists in general have of late years been unable to form a satisfactory opinion, so contradictory and well-balanced has been the evidence for the various hypotheses, appears now somewhat nearer to a decisive settlement, since within the last year we have had no less than four elaborate and comprehensive essays presented to us, detailing the whole series of changes which the ovule passes through, from the opening of the bud to the ripening of the seed. When the names of Amici and Von Mohl appear as the authors of two of these papers, it will be understood how important these new investigations are; and the fact of the agreement of all four *inter se*, excepting in some trivial points, and the possibility of reconciling their results with the *appearances* which have presented themselves to authors holding different views, will probably cause them to be regarded as tolerably conclusive. The great result at which all these recent writers have arrived is, that Schleiden's statement, that the end of the pollen-tube becomes the embryo, is incorrect, and that the old opinion, which regarded the pollen as the source of a fertilizing matter necessary to stimulate the embryo-sac to the development of the germ of the future plant, is true; the pollen-tube being consequently merely the agent for the conveyance of the fertilizing matter through the style and the foramina of the ovule, having its progress arrested upon the outside of the wall of the embryo-sac, through which and the membrane of the pollen-tube itself the fecundating fluid is supposed to be imbibed.

The few remarks which it may be necessary for the reporter to make on the relations of these investigations to preceding observations, will be most conveniently reserved till after a general account of them has been laid before the reader.

The first paper we meet with is one read by Prof. Amici before the Italian Congress at Genoa in 1846. Our knowledge of it is derived from German and French translations*.

In the first instance the author refers to some observations previously made public upon *Cucurbita Pepo*, in which he showed that the pollen-tube penetrates into the neck or summit of the nucleus to a certain depth, but *never* into the embryonal vesicle†,

* On the Fertilization of *Orchidaceæ*, by Prof. J. B. Amici, Giornale Botanico Italiano, di Filippo Parlatore. (Transl. Ann. des Sc. Nat. 3 sér. vii. 193, April 1847; and by Von Mohl, Bot. Zeitung, May 21 & 28, 1847.)

† By *embryonal vesicle* Prof. Amici signifies the embryo-sac, and this must

which pre-exists and is visible in the nucleus before the introduction of the pollen-tubes into the ovules. Probably the impregnation is effected by the passage of the fertilizing fluid through the membrane of the embryonal vesicle, this fluid being conducted to or deposited in the vicinity, or even on the surface of the latter. It is certain that the vesicle only acquires the power of development after the pollen-tubes have penetrated the coats of the ovule, and poured out the fluid which they contain upon it; it dies without having shown any signs of growth when it is not moistened by the fertilizing fluid.

The subsequent development of the embryonal vesicle shows itself first towards the base; that is, at the point opposite to where the pollen-tube acts. All trace of this tube has disappeared by the time the enlarged embryonal vesicle begins to multiply its cells; these become enlarged, particularly toward the base of the nucleus, finally reaching its walls, thus entirely filling its cavity, and even causing its rupture. The form which the embryonal vesicle ulteriorly assumes in the course of development is that of a constricted sac (the embryo-sac), within which, at the summit, many days after the epoch of fertilization, a greenish body makes its appearance, which is the true embryo of the new plant.

From these facts, which are constant, it follows that the pollen-tube is not transformed into the embryonal vesicle*, because the latter exists already in the unfecundated ovule: still less is the pollen-tube developed into the embryo, for the embryo is not produced till long after, when the vesicle, very much enlarged, has become the embryo-sac. Moreover, the embryo is visible long before its diameter is equal to that of a pollen-tube, so that this latter cannot have become converted into it.

"In reference to *Cucurbita Pepo* therefore," says Amici, "I could be certain that Schleiden's theory was incorrect, and, microscope in hand, offer direct demonstration. Analogy led me to believe that in other plants, where the action of pollen is necessary to fecundation, the opinion of the German botanist was inadmissible; and I was the more strengthened in this conclusion, that in my numerous earlier researches in other plants, I had never seen the pollen-tube either lodge itself in the embryonal vesicle when the latter existed before fertilization, or itself become the embryonal vesicle."

After stating that although he had not extended his observations to the families *Orchidaceæ* and *Asclepiadaceæ*, he was induced

not be confounded with the *germinal vesicle*, which is the first cell of the embryo.—*Rep.*

* There is some confusion in the translations here: in the French this is given *vésicule embryonnaire*; but Prof. Mohl uses the term *Keimbläschen* (germinal vesicle), with the synonym *vesichetta germinativa*.—*Rep.*

to presume, from his knowledge of the researches of MM. Brown and Ad. Brongniart, that there was no essential difference in the mode of fertilization in these families, M. Amici goes on to say that he considered new researches necessary to the confirmation of his conjectures, and this more than ever after the publication of the supplemental note of Mr. Brown, in which the "mucous tubes," instead of being regarded as pollen-tubes, were stated to be apparently distinct from them, although engendered or produced by their influence. If this last statement were incontestable, not only would Schleiden's theory be totally overturned, but Amici's idea, that the elongation and penetration of the pollen-tube into the coats of the ovule is a general law, would be devoid of ground.

The want of means and leisure had prevented the prosecution of his researches on this subject until the publication of Gasparini's observations on *Cytinus hypocystis* revived M. Amici's desire to determine these points, and he commenced a minute investigation of the organs of fructification of the *Orchidaceæ*. These have confirmed him in the earlier opinion of Mr. Brown, and he regards the strings of tubes descending into the ovary as really bundles of pollen-tubes. He has moreover been able to determine the precise state of the ovule before the arrival of the pollen-tube; then, how the latter penetrates the coats and behaves in relation to the embryonal vesicle; and lastly, observed the immediate changes which follow, in the ovule, the introduction of the pollen-tube. All these go to support his former observations, and exclude the idea of the conversion of the extremity of the pollen-tube into the embryo.

In the first place is offered the evidence on which he founds the opinion that the six bundles or cords of tubes descending into the ovary are prolonged pollen-tubes. Regarding the description of the appearance and course of these tubes, given by Mr. Brown, as altogether agreeing with the characters of pollen-tubes in other phanerogamous plants, it only remained to determine the identity of the pollen-tubes attached to their granules, and entangled in the thickness of the stigma, with the other tubes of a supposed different origin, and (hypothetically) produced in the immediate vicinity of the former; this identity was established several times by compressing the stigma between two glass plates, and observing that the tubes were continuous with each other. The slight peculiar characters proposed to be founded on the coagulations, &c. in the "mucous tubes," Amici considers valueless for distinguishing them from pollen-tubes; these coagulations, sometimes interruptions of the continuity of their cavities, being consequent on the gradual withering of the layers of the stigma and style, which interferes with the communication with the parts

above, and the upper part of the tubes thus remains destitute of granular matter or fertilizing fluid, because the latter is always carried toward their lower extremities. To the objection that the tubes are too numerous to be produced from the pollen-grains, the author opposes the fact of the enormous number of granules contained in the pollen-masses; for instance, in *Orchis Morio* the two principal pollen-masses contain each no less than 200 secondary masses; and the latter, which when compressed divide into granules united in fours, individually present more than 300 orifices from which pollen-tubes may be emitted; consequently in all no less than 120,000 tubes may be produced. Again, in *Orchis abortiva* the moistened point of a needle will take up several thousand of the simple spherical pollen-grains, and in this species the progress of the pollen-tubes along the conducting tissue of the female organ may be easily followed, affording conviction that the mucous cords are neither more nor less than prolongations of them.

With regard to changes of relative position of the parts of the ovule in the ovary occurring before the period of fertilization, the author does not consider it worth while in the present day to stop to discuss them, since it is known that in whatever direction the orifices of the coats of the ovule point, the ovules may be fertilized by filaments floating freely in the cavity of the ovary. He notices that M. Brongniart found instances of this in *Helianthemum niloticum* and *ægyptiacum*, without however recognizing the free filaments to be pollen-tubes; and he himself has seen similar filaments free in the ovary of *Cresta gialla**, which possesses no conducting tissue.

The first researches of Professor Amici on the *Orchidaceæ* were made on *Orchis Morio*. At the period when the corolla expands, the ovule is so far developed, that the testa, the tegmen and the nucleus, or the primine, secundine and nucleus, may be distinguished; the latter consists of a large central utricle inclosed in a layer of smaller cells; it resembles an acorn, the teguments representing the cupule.

Subsequently this cellular layer or membrane which clothes the nucleus opens like a tulip, and the nucleus, consisting of a simple cell, remains wholly uncovered, so that a granular fluid collected toward the apex may be seen in its interior. It might be supposed that this exposure of the nucleus indicates the fitting moment for fertilization, but this is yet far distant.

When the flower has begun to wither, a new transformation has taken place in the ovule. The testa and tegmen have in-

* *Cresta gialla* is translated Cockscomb, with a query, by Prof. Von Mohl. In the Ann. des Sc. Nat. it is considered as *Rhinanthus crista galli*. It seems most probable that *Celosia cristata* is the plant in question.—*Rep.*

creased in size; the tegmen still projects beyond the testa, but the nucleus is covered by both membranes, and has not perceptibly enlarged. But the granular fluid formerly collected at its upper extremity has become converted into a cell, which is the embryonal vesicle (*vesichetta embryonale*), and is filled with a similar fluid.

Another epoch succeeds the withering of the flower. The stigma (or stigmata, for there are three) show by their decay that they are dead. The pollen-mass has already acted upon them; the pollen-tubes, after having traversed their tissue and that of the style, have become prolonged into the evidently enlarged ovary. The ovule has equally undergone a change; the tegmen no longer projects beyond the testa; it is contained within it. The nucleus retains its relative situation within the tegmen, and the embryonal vesicle, which is always adherent to its upper end, exhibits the granular fluid, previously distributed throughout its cavity, collected toward its base. [Prof. Von Mohl, in his translation, here explains that the author, by the apex of the embryonal vesicle, signifies the end corresponding to the apex of the nucleus; and by the base, the end hanging free in the nucleus; an explanation rendered necessary by the anatropous condition of the ovule.] The ovule is now exactly in the condition to receive the influence of the pollen. The pollen-tube enters by the orifice of the testa, and its progress into the interior of this first coat is as visible as though no membrane intervened; its passage through the canal of the tegmen is not always so clear, for either from an actual narrowing of the canal, or from an optical illusion resulting from the cylindrical form of the cells of the tegmen which bound it, the diameter of the tube appears to be much diminished. But there can be no doubt of its prolongation when its extremity is clearly seen to pass out from the narrow canal of the tegmen and into the cavity of the nucleus. The question now is, does it push back the pre-existing embryonal vesicle in order to enter its cavity? To this Prof. Amici replies, most decidedly, no. The pollen-tube merely comes in contact with the side of the upper part of the embryonal vesicle, and remains adherent to it, finally withering and disappearing. The end of the pollen-tube, filled with a greenish and granular fluid, contrasts distinctly with the embryonal vesicle, which in the upper part, where it is in contact with the tube, is filled with a limpid fluid; while below, where the pollen-tube never reaches, it contains a white granular fluid. This condition of the circumstances, the author says, is so constant, that he can tell at a glance whether an ovule has been fertilized or not. Whenever the embryonal vesicle presented itself with the pollinic appendix just spoken of, he was certain of finding the tube engaged in the coats of the

ovule, while he never met with it when the appendix was wanting.

After fertilization, the granular white fluid contained in the embryonal vesicle becomes condensed, and appears evidently contained in a new cell, which shortly after subdivides into several others filled with granules; then these become extremely multiplied, and thus form the embryo which by degrees comes to occupy the whole of the cavity of the nucleus. At the same time, the other portion of the embryonal vesicle, that which was in contact with the pollen-tube, becomes elongated upward, dividing likewise into cells, but into cells which are transparent and situated one above another, so as to form a large confervoid filament; this traversing in the opposite direction the course followed by the pollen-tube, enlarges and passes through the orifices of the tegmen and testa, and becomes prolonged even into the interior of the placenta (observed in *Orchis mascula*).

The pollen-tube usually disappears during this period, but occasionally it may still be seen with its extremity *in situ*, even after the cells of the embryo have been multiplied. It is not rare to find it in this condition in *Orchis abortiva*, and the author has once observed it persistent even to the period when the reproductive body had filled the whole cavity of the nucleus.

Orchis abortiva is better adapted for these observations than *O. Morio*, and particularly for observing the introduction of the pollen-tube into the orifice of the tegmen, since in this species the state of the ovule at the epoch of fertilization is such that the testa only covers the lower half of the tegmen and nucleus. *O. maculata* appeared a less favourable subject than *O. Morio*, but it afforded proofs that the phænomena were identical in the two species. The author imagines that *O. pyramidalis* would offer great facilities for these researches, as the ovule appeared to him to be extraordinarily transparent; he was unable to follow its entire development, having only at hand a single withered specimen.

Prof. Amici states directly that he is unable to say what is the real action of the pollen-tube upon the ovule in impregnation. However he considers it probable, although it cannot be demonstrated, that the subtile fluid of the pollen-tube filtrates through the membranes into the interior of the embryonal vesicle, and that the mixture of the fluids of the male and female organs constitutes the organizable substance. It is also possible that the generative power resides in the membrane of the embryonal vesicle, and that the imbibition of the liquid brought by the pollen is necessary to set this power in action. Other explanations of the phænomena might be offered, the author says, but it is not his intention to give himself up to speculation, to lose himself in the field of hypotheses. He adds merely one fact,

namely, that in his numerous investigations he has never found more than one pollinic filament within the nucleus, although he has several times met with two embryonal vesicles, and consequently two embryos fertilized by a single tube.

Prof. Von Mohl* has published an account of his elaborate investigations on this subject made during the spring of 1847, his attention having been newly directed to it by the observations of Amici above-related. They agree almost perfectly with the latter, but considering the interest attaching to the inquiry, it may be as well to give an account of the points not fully described by Prof. Amici, and the slight discrepancies which exist between the accounts given by the two observers.

Prof. Von Mohl states that the pollen-tubes are easily distinguished from the cells of the conducting tissue of the style by their greater length and their much smaller diameter; that of the pollen-tubes being on an average $\frac{1}{180}$th of a millimetre, that of the cells of the tissue of the style $\frac{1}{60}$th; and he states that the "mucous tubes" of Mr. Brown are certainly the pollen-tubes.

About the fourth to the sixth day the ovary has become twice or thrice as large as at the time of the expansion of the flower; the ovule has become greatly inclined, and the coats of the ovule have grown, the inner some distance upward on the nucleus, the outer not so far as the inner. The nucleus has become enlarged upward in a clavate form; the embryo-sac is relatively much increased in size, so that the cells which form the outer layer of the nucleus are flattened, and form a comparatively thin investment to the embryo-sac which they inclose.

In about seven or eight days the ovule is perfectly anatropous; the inner coat has become much longer than the nucleus, and the outer coat attained a length about equal to the latter. The nucleus possesses essentially the same structure as before.

In this last observation there is a disagreement with Amici's, since he says that the outer layer of the nucleus opens by the separation of its cells, before the coats of the ovule grow over the nucleus. This Von Mohl could not detect; on the contrary, he perceived the outer cells forming an envelope to the embryo-sac up to the tenth or twelfth day. During this time the embryo-sac has become much enlarged, and its former polyhedral form changed into an ovate. Its cavity is no longer, as before, perfectly filled with protoplasm, but a space filled with watery fluid has formed in the midst, and the protoplasm principally accumulated at the two ends of the embryo-sac, particularly at the upper. The coats have by this time become very much larger in proportion to the nucleus; the inner projects a good way be-

* Ueber die Entwicklung des Embryo von *Orchis Morio*.—Botan. Zeit., July 2, 1847.

yond its apex; the border of its mouth is swollen into a kind of roll, and the canal leading from it to the nucleus has begun to diminish in diameter. The outer coat begins to elongate downward from the lower end of the ovule in the form of an obtuse hollow spur. The pollen-tubes have by this time reached the lower end of the placenta.

About the end of the second week the embryo-sac has wholly displaced the outer cellular layer of the upper and larger half of the nucleus. How this occurs the author could not clearly make out, and he leaves undetermined whether these cells are compressed gradually until their cavities are obliterated, and whether their membrane finally becomes blended with the embryo-sac or is absorbed. The outer coat now projects beyond the inner, and the canal of the latter becomes sensibly narrower, the mouth of the outer coat still continuing widely open. The pollen-tubes form a dense interlacement of curling filaments with knot-like swellings upon the placenta; their diameter is from $\frac{1}{113}$ to $\frac{1}{70}$ millim.

The external form of the ovule remains henceforward without much alteration, but a series of changes of the highest importance now ensues in the contents of the embryo-sac. The mass of protoplasm collected at the upper end, which hitherto appeared in the form of a simple deposit in the interior of the wall of the upper part of the cell, begins to separate into three masses, rounded below, connected together above. These masses are the first traces of the formation of three contiguous cells; the nucleoli of each of these cell-nuclei can be distinctly seen before any trace of their membrane is visible. No sharp line of demarcation between the nuclei themselves, or between them and the protoplasm, can originally be detected; this is either because the nucleus is subsequently formed by a firmer union of a portion of the protoplasm, or its substance differs so little from the surrounding protoplasm in optical qualities, that the line of division escapes the eye. The conversion of these masses of protoplasm into ovate cells, which become enlarged downward to reach about the middle of the embryo-sac, takes place rapidly; the author states that he has reason to assume that this change takes place, as a rule, in twenty-four hours. In proportion as these cells become elongated downward, the protoplasm contained within them, enveloping their nuclei and originally occupying their entire cavity, is drawn downward toward the lower end; that is, the end turned away from the apex of the nucleus.

This is the epoch when the pollen-tubes, which proceed from the placentas in a very tortuous manner, enter the mouth of the ovule, and now, Prof. Von Mohl says, "the more difficult part of the investigation begins." The pollen-tubes are easily followed

through the canal of the outer coat, but it is very difficult to trace them (as Amici also remarks) through the very narrow canal of the inner coat. The pollen-tubes must not only become diminished to a third or a fourth of their former diameter, but the refraction of the light in the cylindrical cells of the inner coat greatly interferes with distinct vision of its form. Some assistance is obtained by a very slight compression of the object, which is also necessary to expel air-bubbles which remain between the coats and in the canal of the inner coat, when the ovule is viewed in water; and a microscope of the sharpest defining power is very desirable. A magnifying power of 200 diameters suffices, if its lenses be perfectly corrected. The lower end of the pollen-tube reaches the rounded apex of the embryo-sac, and turns toward the side to run a short distance sideways upon it. This of course can only be seen when a side view is obtained; if the pollen-tube lies above or below the embryo-sac, as the observer looks down upon it, he may easily imagine that it is in the interior of the embryo-sac. The circumstance that the pollen-tube follows the curved surface of the embryo-sac well supports the conclusion that it lies upon the outer side of the latter, and runs between its membrane and the inner coat of the ovule. The lower end of the pollen-tube swells up considerably in a clavate form, and then projects, especially at a somewhat later period, a good way into the embryo-sac, probably on account of the pressure it experiences from the coat of the ovule. The next phænomenon is a change in the interior of the lower end of the pollen-tube and its inferior clavate expansion; they no longer contain, like the upper part of the pollen-tube, a clear fluid in which granules are intermixed, and which has not the most distant resemblance to a tissue on the eve of development, or a protoplasm destined to the production of cells; they now exhibit a coagulated, grumous mass, of a greenish-yellow colour. That this mass results from the transformation of the fluid contained in the pollen-tube is evident, from the fact that in certain cases the contents of that part of the pollen-tube outside the mouth of the ovule acquire a similar peculiarity. This coagulated condition of the contents of the lower end of the pollen-tube caused the author to feel doubtful at this stage of his inquiry as to the real point of origin of the embryo, since it seemed possible that this lower end of the pollen-tube was about to become developed into it.

One of the three cells lying at the upper end of the embryo-sac now begins to grow; in rare cases a second follows it in a similar development. The protoplasm of this cell is, as will be remembered, collected at the lower end; in a short time a transverse septum is formed; a second and two more quickly fol-

low, so that this cell (the germinal vesicle) is thus changed into an ovate body composed of three or four cells lying one above another. Of these secondary cells the two situated at the two rounded extremities are of greater diameter than those lying in the middle. Each of them contains a nucleus.

Contemporaneously with the growth and division of the germinal vesicle, the protoplasm collected at the base of the embryo-sac forms itself into an irregular mass of roundish parenchymatous cells, of which some frequently project into the central unoccupied space of the embryo-sac, and even come in contact with the lower end of the germinal body. In the course of the next two or three days the germinal body increases in size so much that it gradually comes to occupy the whole embryo-sac, displacing the cells contained in its lower end; its diameter is now about $\frac{1}{30}$th of a millimetre. At the same time a longitudinal septum is formed in the lowest cell of the germinal body, and soon after in the next above it.

The lower end of the pollen-tube, the swollen, blind extremity of which is about $\frac{1}{100}$ of a millimetre in diameter, undergoes no change during this time.

The lower cells produced by the division of the germinal vesicle grow faster than the upper, so that the form of the structure is changed from ovate to clavate, the larger end downward.

The cells of the upper end now grow upward and form transverse septa, finally passing out through the canals and the mouth of the ovule, as described by Amici, in the shape of a confervoid filament or articulated hair. Originally the end of the pollen-tube lies beside this, so that they cannot be mistaken one for the other. Simultaneously the cells of the lower end multiply and form an enlarged body, the cells of which are filled with a dense mass of granules; this opake cellular nucleus is of course the embryo. The hair-like prolongation of the upper end is distinguished both by its cylindrical form and the transparency of its cells, which merely contain watery fluid with a small quantity of finely granular protoplasm and a cell-nucleus. When the germinal vesicle has thus become developed into the embryo and its filamentous appendages, the pollen-tube disappears, apparently by absorption. At the time when the filamentous appendage becomes elongated, a deposit of spiral fibres occurs in the cells of the outer coat of the ovule, and the seed proceeds rapidly toward maturation.

Comparing these observations with Amici's, it will be seen that they only differ in one point of very small importance, which refers to the mode in which the embryo-sac displaces the nucleus. Prof. Von Mohl deduces from them the conclusion, "*that we must*

consider the pollen-grain, not as the ovule of the plant, but as its fertilizing organ; that Schleiden's theory of vegetable impregnation is false."

He considers these observations as a complete proof of this proposition, since he worked with such care and perseverance that he ventures to consider them incontestable. They refer to a single species alone, and this of a family possessing many peculiarities, but he believes that every one will agree with him in idea that the process of fecundation is essentially the same in all Phanerogamous plants, that is, in reference to the question whether the pollen-grain or the ovule produces the embryo—whatever modifications of the minor points may occur in different families. At the end of his memoir the author offers some speculations which have arisen out of the foregoing observations. He asks whether the three germinal vesicles which are formed in the upper end of the embryo-sac may not be identical in their nature with R. Brown's *corpuscula* in the *Coniferæ*: the chief difference between them appears to be, that in the *Orchidaceæ* the suspensor (the filamentous elongation) consists of a single row of cells and takes a backward course, breaking through the nucleus and growing out into the seed, the embryo remaining in its place; while in the *Coniferæ* the suspensor is composed of several rows of cells and breaks through the embryonal vesicle below, so that the growing embryo at its lower extremity attains its fuller development outside the embryonal vesicle*.

K. Müller † has followed the development of ovules in a number of plants; he gives a minute account of his observations on *Orchis Morio, Monotropa Hypopitys, Begonia cucullata* and *Elatine alsinoides*. He fully confirms the statements of Amici and Mohl with regard to *O. Morio,* the only point of difference being that he could never see the end of the pollen-tube filled with green matter as above described. Otherwise he traced the pollen-tube through the foramina of the coats and saw it lying on the side of the summit of the embryo-sac. His researches in *O. latifolia, paludosa, maculata, militaris, Platanthera bifolia* and *Ophrys ovata* yielded similar results. In all these the embryo was produced from the lower cell of the series produced from the germinal vesicle. In *Monotropa* the pollen-tube is applied directly to the apex of the embryo-sac, and the embryo is here

* It appears to me that this parallel is not well-grounded: have not the corpuscula of the *Coniferæ* rather the import of embryo-sacs, like those of *Viscum,* than of germinal vesicles? This is the opinion of Schleiden.—*Rep.*

† Beiträge zur Entwickelungsgeschichte des Pflanzen-embryo, von Karl Müller.—Botanische Zeitung, Oct. 15, 22 and 29, 1847.

developed out of the middle cells of the series, and thus presents two appendages at a certain stage.

Begonia cucullata offered a very favourable opportunity for the investigation, from the great transparency of the cells of the coats. Here Müller states that he is certain that the germinal vesicle is formed by a cytoblast in the cavity of the embryo-sac. In *Elatine alsinoides* the coats of the ovule are so much developed that it becomes necessary to make a section of the ovule to see what goes on in the embryo-sac. In this plant again the fertilization was found to occur precisely as in the preceding species—the progress of the phænomena is here exceedingly rapid. In *Epilobium angustifolium* the embryo was found to be developed in the same manner, but the author could not trace the pollen-tube to the embryo-sac, a section of the ovule being necessary here also.

W. Hofmeister* has published an account of a series of observations on the impregnation of the *Œnothereæ,* his examples being *Godetia quadrivalvum, G. rubicunda, Œnothera longiflora, Œ. Sellowii* and *Boisduvallia concinna.* His results are in perfect accordance with those already noticed as to the real operation of the pollen-tube upon the embryo-sac; he finds that the pollen-tube does push it inwards a little distance in some instances where the embryo-sac is very delicate, in other cases it is itself distorted by the resistance of the embryo-sac.

The first phænomenon which presents itself in the embryo-sac is an accumulation of the protoplasm at the micropyle end of the embryo-sac, and in this we soon find from two to four free cell-nuclei. Round one of these nuclei (cytoblasts) a cell forms, which is the germinal vesicle; a second is next produced, which sometimes divides into two. From one of these the embryo is developed; and that this is the case, and that the end of the pollen-tube does not become the embryo, is the more certain, since at the time of fertilization the pollen-tube and embryo-sac are so firm that they may be separated with a needle under the microscope; the fertilizing matter must therefore pass through three membranes, viz. those of the pollen-tube, of the embryo-sac, and of the germinal vesicle itself.

In *Godetia* traces of the pollen-tube were found even in the ripe seed, and during the progress of the development of the embryo here the pollen-tube *branches* as it lies in the canal of the inner coat of the ovule, while the cellular layer around the embryo-sac has been absorbed, so that the latter with the contained embryo lies free in the ovule.

* Untersuchungen des Vorgangs bei der Befructung der Œnotheren, von W. Hofmeister.—Botanische Zeitung, Nov. 5, 1847.

From the preceding statements we gather the following general statement of the process of impregnation.

At the period of the opening of the flower the embryo-sac exists, and at its upper (micropyle) end one or more cells (germinal vesicles) are produced from cytoblasts. The pollen-tube makes its way down the style into the ovary, and finally through the foramina of the coats of the ovule, and comes in contact with the embryo-sac; here it either applies itself immediately upon the apex or proceeds a little way further, so as to lie rather on the side of the apex of the embryo-sac. Hereupon (and probably as a result of the imbibition of the fluid of the pollen-tube through the membranes) the cell, or one of them if there are more, lying in the embryo-sac, begins to develope, and in course of time produces the embryo.

We may glance at the evidence to be obtained from the accounts given by authors who deduce conclusions different from the above. Meyen* believed that the phænomena presented themselves with two modifications; the first where the embryo-sac evidently exists before impregnation, and the second where, as he believed, this is wanting at that period. The latter modification, where he said that the germinal vesicle is produced by the end of the pollen-tube, cannot be brought into relation with the theory under examination, but the latter presents some points of resemblance. In this case he stated that the pollen-tube comes in contact with the embryo-sac and becomes united with it, and then the germinal vesicle makes its appearance in the embryo-sac. But in one instance which he figured, namely in *Mesembryanthemum glomeratum*†, he confessed that the absorption of the membranes separating the cavities of the pollen-tube and embryo-sac was an assumption, and the figure in question exactly resembles Müller's representation of the phænomenon, the pollen-tube lying rather to the side of the summit of the embryo-sac. If we could believe that he was mistaken in supposing that an actual union of the embryo-sac and pollen-tube took place (and in such investigations graver errors are easily fallen into), the only point of difference would be with regard to the period when the germinal vesicle is first produced.

In reference to Schleiden's opinions, the view which he first promulgated was that the pollen-tube pushed the summit of the embryo-sac before it and became invested by it, but in the last edition of his 'Grundzüge‡', he admits the possibility in certain cases of the actual entrance of the pollen-tube into the embryo-

* Pflanzen-physiologie, vol. iii.

† *Op. cit.* vol. iii. pl. xiii. figs. 46, 47.

‡ Grundz. des Wiss. Botanik, 2nd edit. ii. 366.

sac, in the manner which is described by Gelesnow*; and the figures to his own memoirs do not always show the depression of the summit of the embryo-sac, but exactly resemble the condition which is figured by Müller from *Monotropa* and *Begonia,* where the pollen-tube is applied upon the apex of the embryo-sac and lies in a line with the embryo. Here his statement, that he has drawn out the pollen-tube from the embryo-sac, with the embryo at its extremity, must be set against Hofmeister's affirmation that he has detached the pollen-tube from the apex of the embryo-sac without disturbing the germinal vesicle.

Finally, the whole question now appears to be narrowed to the determination of the point, whether the germinal vesicle does actually exist before impregnation, since if that can be proved, all appearances yet observed may be reconciled, by allowing for very slight errors in interpreting and delineating them. Amici does not express himself very distinctly on this point, but the other three papers which have just been investigated, added to the opinions of Brongniart† and Mirbel‡, will probably satisfy many upon this point.

P.S.—Since the above was written I have found that L. R. Tulasne§ has given a brief *résumé* of some researches into the embryogeny of *Veronica hederæfolia, triphyllos* and *præcox*. According to his statements, the pollen-tube here actually perforates the embryo-sac and lies within it; the end of the pollen-tube becomes the embryo and at no period can any *germinal vesicle* be distinguished. These observations therefore go to support the modified views of Schleiden, but until they are more distinctly detailed by their author, their true value can hardly be estimated.

VI.—*Additions to the Fauna of Ireland*‖. By William Thompson, Esq., Pres. Nat. Hist. and Phil. Society of Belfast.

Aves.

Bridled Guillemot, *Uria leucophthalmos*, Faber.
—— *lacrymans*, Valenc., Gould, Yarrell.

A communication from Richard Chute, Esq., of Blennerville, county of Kerry, dated Feb. 26, 1846, informed me of his having once shot this bird at Dingle.

* Botanisch. Zeitung, i. 841.

† Mem. sur la génération de l'embryon, &c., Paris, 1827.

‡ Ann. des Sc. Nat. 2e sér. xi. 200 and 381.

§ Comptes Rendus, June 14, 1847.

‖ This short communication was intended to be supplementary to two papers on the same subject in the 20th volume, but was too late in being forwarded for that purpose.

Pisces.

"*Syngnathus ophidion*, Linn.," Yarr. Brit. Fish. v. ii. 447, 2nd edit

A specimen taken in the dredge with oysters, at Killinchy, Strangford lough, in October last, happened fortunately to be brought with them to Belfast market, where I procured it. Its length is eleven inches; the characters all as described by Yarrell. After being preserved in spirits for some weeks its colours are a mixture of very pale bluish and brownish olive, with a fine black interrupted or non-continuous line along the back from the head to the dorsal fin:—whitish spots along the medial line.

Mollusca.

Idalia aspersa, Ald. & Hanc. Brit. Nudib. Moll. part 1. pl. 26.

One of this species, hitherto only known from a single individual procured on the coast of Northumberland by the authors referred to, was dredged in about seven fathoms water off Bray Head (county of Wicklow) last July by Mr. R. Ball. When living it is said to have been somewhat of a dull rosy hue. The specimen is now (probably being contracted in spirits) five lines in length: it was submitted to Mr. Alder's inspection.

Tellina pygmæa, Phil. MS.; Lovèn, Index Moll. Scandinaviæ, p. 42 (1846).

Specimens procured on the coast of Cork by Mr. John D. Humphreys are—as Mr. S. Hanley informs me—in Mr. Jeffreys's collection at Swansea.

Ascidia tubularis, Müll. Zool. Dan. iv. p. 12. t. 130. f. 3.

One of this species, about twice the size of that represented in the 'Zoologia Danica,' was dredged from pure sand at about six fathoms depth in Ballyhome bay, co. Down, in July 1846 (Mr. Hyndman & W. T.). Professor E. Forbes, to whom the species was previously known, says that it is common in the Hebrides.

Ascidia grossularia, Van Beneden, Recher. Ascid. Simples, pl. 4. f. 7.

This species, defined as having the "test corné, presque lisse, de couleur rouge," and being always known by its bright red colour, of which the vitellus also is, was found in abundance on oysters at Brit-lingsee by its describer. What I consider to be the same species is likewise abundant on shells, stones, and occasionally on *Laminariæ*, dredged from a few fathoms depth on the north-east coast of Ireland. It seems to me identical with what is represented in the 'Zoologia Danica,' vol. i. p. 15. t. 15. f. 3, as the *young* state of *Asc. rustica* (previously noticed by me in the 'Annals,' vol. v. p. 94). No allusion however is made by Van Beneden to the *A. grossularia* resembling any other Ascidia: but I agree with him in considering it a perfectly

developed species, and consequently am of opinion that what Müller considered its adult state is another species.

Amaroucium albicans, Edw. Ascid. Comp. p. 71. pl. 1, 3 *b.*

Dredged from several fathoms in Belfast bay (1839) and on the Galway coast (1840), W. T.

Mr. McCalla mentioned to me last spring that he had collected this species on the Irish coast.

Didemnum gelatinosum, Edw. Ascid. Comp. p. 79. pl. 7. f. 5 ?

Adherent to *Serpula tubularia* dredged in Strangford lough, Oct. 1839, &c., W. T.

A species apparently of this genus may not uncommonly be found investing the stems of *Halidrys siliquosa.* It is of a pale gray colour, and may be said to give the plant the appearance of being besmeared with bird-lime.

Botryllus violaceus, Edw. Ascid. Comp. p. 89. pl. 6. f. 4.

On Fuci, Belfast bay, W. T.

Botryllus smaragdus, Edw. Ascid. Comp. p. 91. pl. 6. f. 6 ?

A species taken at Holywood, Belfast bay, by Dr. J. L. Drummond, in the summer of 1846, of which he made a drawing and noted the colour, seems to be the *B. smaragdus.* The notes are not in sufficient detail to ensure certainty.

The last four have not, that I am aware, been made known as British species :—the *genus* Didemnum indeed seems unnoticed. Dr. Scouler has met with it on the Irish coast.

Crustacea.

Crangon fasciatus, Risso, Hist. Nat. de l'Eur. Mérid. v. 64; Edw. Hist. Crust. iii. 342.

Among Crustacea lately submitted to my examination by Mr. R. Ball are two individuals of this species, which were taken by him at Bray in July last. They are nearly one inch in length, and exhibit masses of mature ova. The species is admirably characterized in Milne-Edwards' description above referred to. Its short thick *form* at once arrested my attention as distinct from that of *C. vulgaris* :— the *colour* designated by the trivial name *fasciatus* does not so distinguish it. One specimen exhibits a blackish band on the fourth segment of the abdomen and the other none; and the greater number of specimens of *C. vulgaris* from various parts of the Irish coast examined in reference to this character have more or less of a blackish band on this segment. It is slightly shown too in Sowerby's figure on Leach's Malacost. Podophth. Brit. This species has not been noticed as British, but has I believe been lately obtained by Professor Bell.

Praniza cærulata, Mont. (sp.)?

A letter from A. H. Haliday, Esq., dated October 9, 1847, conveyed the following information:—"I found a species of *Praniza* pretty common on the clayey shores of Strangford lough last week, in company with *Anceus maxillaris.* They were in small cavities on the surface of the clay under stones, sometimes singly, oftener two, or even three and four in each hole; the smaller slender green ones were few in comparison. You will find some of the new-born young with them, having all the characteristic form of the parent, but the posterior thoracic segments not so completely confounded together. I have given but a hasty look at them, but have not recognized ♂ among the adults."

Along with the Crustacea since received from Mr. Ball were sent specimens of a *Praniza*, purchased of Mr. McCalla as collected on the Irish coast, but no locality is given. They were obtained previous to those first noticed.

Bopyrus hippolytes, Kroyer, Gronl. Amfip. p. 78. pl. 4. f. 22.

Two females of this species were found within the carapace of the *Hippolyte varians*, Leach, which I obtained on the coast of Galway in July 1840. M. Kroyer found it on the *Hippolyte polaris.*

Sida crystallina, Müll. (sp.) Edw. Crust. iii. 385.
Daphnia crystallina, Müll. Entomost.

Professor Allman lately sent me sketches of a *Daphnia* obtained by him during autumn in a little subalpine lake near Killarney, where it was in profusion adhering to the under sides of the leaves of the water-lily (*Nymphæa alba*). On the sketches being transmitted to Dr. Baird of the British Museum, he at once recognized in them the *D. crystallina*, Müll. (*Sida*, Straus), adding that he had met with the species but in two localities—near London—and in both sparingly.

Zoophyta.

Hippothoa sica, Couch, Cornish Fauna, part 3. p. 102. pl. 19. f. 8; Johnst. Brit. Zooph. p. 292, 2nd edit.,

I find within a very large dead *Pinna* dredged at the entrance of Belfast bay. Mr. Couch's description, but not his figure, is applicable to my specimen. The striking characters may be noticed. The length of the cells is as described, "about four times their transverse diameter," and the apertures "are long and tubular, frequently as long as the cell." But whether this remarkable form may not be due to the security and freedom from injury enjoyed by the zoophyte within the closed valves of the *Pinna*, I shall not, from the examination of a single specimen, pretend to determine. Mr. Couch's specimens were however procured "on stones, from deep water, common." But for this character (which probably may not be permanent) I should not enumerate my *Hippothoa* as distinct from *H. divaricata*, which too is described by Dr. Johnston as sometimes having the apertures "*shortly* tubular."

VII.—*Description of a new species of* Coccinella *from New Zealand.* By M. Mulsant of Lyon, author of the 'Histoire Naturelle des Coléoptères de France.' Communicated by Adam White, F.L.S.

Coccinella antipodum, Mulsant. Cocc. ovata, glabra, thorace luteo lineis duabus obliquis nigris, antice abbreviatis. Elytris virescenti-griseis, macula obtriangulari juxta scutellum, linea longitudinali antice et postice valde abbreviata, margineque inæqualiter, luteis; pectore rufo; abdomine nigro; pedibus luteis.

Body oval. Head, antennæ and palpi of an orange-yellow; eyes black; prothorax anteriorly with a bisinuate notch, the central portion projecting at least as far as the angles when the insect is seen perpendicularly from above, the anterior angles projecting in the form of a tooth, subcurvilinearly dilated on the sides; from the apex to the base subrotundate on the posterior angles, with the convexity towards the elytra, with narrow raised margins on the sides; moderately convex, smooth, punctate, of an orange-yellow, with two longitudinal oblique black lines diverging posteriorly, each connected with the outer third of the base, and extending somewhat irregularly to about the anterior fourth, corresponding by their outer side to the inner side of the eyes. Scutellum triangular, yellow. Elytra one-fourth broader anteriorly than the prothorax at its hinder portion, three times as long or somewhat more, subrotundate at the shoulders, forming an oval truncated in front, but an acute ogiv posteriorly, with a narrow margin and faint groove near the shoulders; moderately convex, more distinctly punctated than the prothorax; the humeral sides prominent, of a grayish green, somewhat obscure, and ornamented with—1. a subtriangular spot near the scutellum; 2. an irregular band, taking its rise from the centre of the base, broadest in the first half of the sides, where it occupies about a sixth of the breadth; and 3. with a longitudinal line, becoming broader posteriorly where it is truncated, and situated near the centre; yellow. Under side of body fawn-coloured on the breast, with the venter black; epimera and postpectus of a yellowish white; mesosternum entire; abdominal plates in the form of a V, extending to the hinder margin of the ring: legs of an orange-yellow.

Hab. New Zealand.

The above detailed description is made from a specimen of *Coccinella* sent to Dr. Joseph Hooker, R.N., by the Rev. William Colenso, subsequently to the publication of the insects of New Zealand in the 'Zoology of the Voyage of H.M.SS. Erebus and Terror.' Dr. Hooker kindly put into my hands a bottle of in-

sects from New Zealand, which contained this and some other unrecorded species. I hasten to publish it, as the *Coccinella Tasmanii* of the above Fauna is only a variety of the Australian *C. leonina*, Fabr.

M. Mulsant gave me this description for the second and forthcoming part of the 'Fauna of New Zealand,' but I prefer publishing it at once. The name he had provisionally given it having been used by Klug for a Mexican species of the family, I have given it another name.

I may mention, that since the publication of the Fauna alluded to, I have ascertained the following to be the correct synonyms of one of the Longicorn Beetles mentioned there:—

ÆMONA VILLOSA.
Saperda villosa, Fabr.
Saperda hirta, Fabr. (olim).
Æmona humilis, Newman, Entomologist, p. 8.
Isodera villosa, White, *l. c.* t. 4. f. 1.

We have only received within the last week a small box of insects at the Museum from Dr. Andrew Sinclair, R.N., the Colonial Secretary, perhaps the most interesting feature of which is a rather small species of *Mantis*.—A. W.

BIBLIOGRAPHICAL NOTICES.

The History of Barbados. By Sir ROBERT H. SCHOMBURGK, Ph.D. &c. Royal 8vo, 772. London, 1848.

THIS new proof of the indefatigable activity of its well-known author consists of a portly volume, containing a geographical and statistical description of the island, with a sketch of its history, and, what brings it more particularly within our province, an account of the geology and natural productions. This third division forms a very important feature of the book, and is much more perfect than such portions of topographical works usually are; in addition to the very interesting geological details and special natural history, we find copious lists of the organic forms, vegetable and animal, inhabiting the island, which are chiefly the fruits of the author's personal researches. These lists are prefaced by brief introductory notices which will add much to their interest in the eyes of general readers, and the author states that want of space alone prevented his adding a popular account of the plants with their uses and properties; he still looks forward to the composition of a Flora of Barbados.

In describing the general outline and aspect of the island, Sir Robert compares it in size and in some measure in outline to the Isle of Wight. "It is almost encircled by coral reefs, which in some parts, as in the parish of St. Philip, extend for nearly three miles to seaward, and prove very dangerous to the navigation. The shore

rises boldly to a height of from thirty to fifty feet on the northern point and on the south-eastern part of the parish of St. Philip, but otherwise we find long lines of sandy beaches, which are protected against the encroachments of the sea by coral reefs."

Although possessing no very elevated points, the surface is exceedingly irregular; the highest point is Mount Hillaby, 1147·55 feet. "If we choose this point as our station, we observe clearly two structures well-defined and geologically different from each other. A narrow strip runs parallel, to the west, with the coast from north to south. We may easily trace it from Bridgetown to almost the extreme end of the island, where, in the neighbourhood of Harrison's, a bold bluff point ends it, from whence the coast assumes the rugged outlines which cliffs of soft material generally present where encroached upon by the battering power of the breakers of a stormy sea. From the west or leeward coast, the ground rises in very distinct successive terraces to the central ridge. These terraces are interrupted by ravines (called gullies in the island). If we turn now to the east, an aspect of a quite different nature presents itself; we see before us a mountainous country in miniature; hills of a conical form radiate from the central ridge, and chiefly from Mount Hillaby in a north-eastern direction towards the sea-shore; their sides are rugged and worn by the heavy rains and mountain torrents, their colour being generally of a dark reddish-brown, here and there tipped with whitish marl. This district has been represented as similar to the alpine country of Scotland, which name has been adopted for it." Mount Hillaby is not exactly in the centre of the island, but rather in the middle of the northern and larger portion of the island, divided from the southern by a deep valley running from east to west; "the southern division is an imitation of the northern on a smaller scale, only that the line of its greatest length stretches from east to west, while in the northern division it extends north and south." The western aspect of Barbados presents a succession of terraces of table-land rising precipitously from one another; the south aspect is similar, but the total elevation is not so great. The north offers a considerable extent of champaign country with Mount Gilboa and Boscobelle rising suddenly from it: seen from the east the island is wild and picturesque, the cliffs rising almost abruptly from the sea to a height of nearly a thousand feet.

The Caribbee Islands form two geological groups; the one, calcareous, is external and exposed to the direct action of the Atlantic; while the other, volcanic, includes the inner islands. Barbados is the most eastern of the calcareous chain, and its aspect indicates at once its origin from the coral animals.

Our author divides the now existing rocks of Barbados into two formations, viz. the Coralline limestone and what, from its locality, he terms the "Scotland" formation. The coralline limestone includes beds of calcareous marl containing recent shells in large numbers and many species; the "Scotland" consists of strata of sandstone, siliceous and calcareous, siliceous limestone, clays, selenite, earthy marls often containing fragments of pumice, strata of volcanic

ashes, seams of bitumen and springs of petroleum (Barbados tar). The coralline limestone occupies six-sevenths of the whole area of the island, and the author considers that the terraces it presents are owing to gradual elevation with intervening periods of rest and subsequent denudation, and gives a detailed account of the present condition and probable progress of the changes it has undergone. Casts of the shells of *Turbo*, *Lucina* and *Petricola* occur at the highest elevations of the coral rock; the shells found eight hundred or a thousand feet lower still retain their lustre, but though resembling those of the adjacent seas, are usually much larger than the recent.

The "Scotland" formation presents a very different appearance and structure from the coral; the district in which it occurs is encircled by a semicircular range of heights from which long ridges of hills project, converging towards each other and diminishing in height as they approach the sea. The various modifications of tertiary rocks of this district manifest an original uniformity, but present great signs of disturbance, and the stratification varies from horizontal to vertical, or is wavy or even contorted; thus it is often difficult to ascertain the dip; the direction is generally south-west and north-east.

The earthy marl constitutes by far the greater part of this series, and it sometimes occurs stratified. It abounds in Polycystina: in the marl from Mount Hillaby Ehrenberg found 54 species, belonging to 22 genera; another specimen gave 113 species of Polycystina with 5 of Polygastrica, 1 Geolithia and 2 Phytolitharia. To the south the marl is succeeded by sandstones. The bituminous sandstones are intermixed with the more calcareous varieties. As to the age of these rocks, our author says, "the *Scalaria* which I found on the summit of Bissex Hill and the *Nucula* of Springfield, induced Prof. E. Forbes to consider the Scotland rocks as belonging to the miocene period of the tertiary strata. The mineralogical character of rocks is considered at present of little importance when conclusions respecting their age are to be formed. Still my observations on the spot, combined with the mineralogical character of the rocks, lead me to coincide in Prof. Forbes's opinion. The chalks of Caltanisetta, on which Prof. Ehrenberg rests his opinion that the Scotland formation in Barbados belongs to an older period than the miocene group, have been considered by different geologists as belonging to different periods; by some they have been regarded as secondary, by others as tertiary rocks."

The whole Scotland district is apparently an old sea-bottom, and the author attributes its present disturbed condition to volcanic agency acting from given points and thus giving rise to local derangements. The presence of pumice and strata of volcanic ashes render this less doubtful. Isolated rocks of the coral formation are found lying on the summits and declivities of hills in the Scotland district; these Sir Robert is inclined to regard as fragments detached from the cliffs which now border the district (and which, with the exception of Mount Hillaby, all exceed in height the "Scotland" hills), before the upheaval of the sea-bottom.

A description of the fossils follows this chapter, containing an

illustrated account of the Polycystina, also a new *Scalaria, Ehrenbergi*, and two *Nuculæ, Parkeri* and *Schomburgki*, described by Prof. E. Forbes.

The botanical portion, prefaced by a few general introductory remarks, contains a list of the Barbados plants; to the scientific names are added the vernacular names by which they are known in this island, and frequently the French or other foreign names used in the adjacent colonies. It contains all the species indigenous, naturalized or cultivated, the two latter being distinguished by the addition of the name of their native country. Next follow alphabetical arrangements of the vernacular names, one English and another foreign, which referring by numbers to the scientific lists will be useful to local botanical students, and are not without importance to us at a distance. A single new species, a lichen, *Endocarpon flavidum*, Taylor, is described. In the zoology the different classes are treated *seriatim*; after an account of the zoophytes, we come, under the head of Insecta, to some interesting details concerning the Sugar Ant (*Formica omnivora*, L., *Myrmica omnivora*, Latr.), whose ravages have often so fearfully interfered with human industry. They showed themselves first in 1760 in Barbados, and our author states, on the authority of Dr. Coke, that "it was deliberated whether that island, formerly so flourishing, should not be deserted" on account of the dreadful devastation they caused. It appears that these ants do not actually feed on any part of the sugar-canes or the leaves of trees, but make their nests under the roots, which protect them from heavy rains, and, being firmly fixed in the ground, place them in security against the agitation of the usual winds. The *stool* of the sugar-canes is firmly attached to the earth, and almost impenetrable to rain; the trees of the orange tribe afford similar advantages to the insects, while the coffee, cacao, plantains, &c. are not molested. The ants apparently live entirely on animal food, and not only attack dead substances, but living bodies; thus small animals and poultry perish when not assisted, and it becomes necessary to guard the eyes of cattle by a circle of tar, to prevent them from being blinded. The destruction of these creatures was attempted with poison and fire during the "plague" following 1760, but all attempts proved ineffectual till the hurricane of 1780, before the violence of which the Sugar Ant disappeared. In 1814 they again made their appearance and caused considerable injury, but soon disappeared. They are still to be found in Barbados, but only in small numbers. The Great-headed Ant or Cushi, *Formica cephalotes*, Fabr., is equally destructive, attacking the leaves of trees and of vegetables, such as the sweet potato, cassada, &c. The White or Wood Ant (*Termes devastans*, Kollar) is another of the plagues of Barbados.

Among the enemies of the sugar-cane are enumerated the Borer or Yellow Blast, the grub of one of the Pyralidæ, *Diatræa sacchari*, Guilding, which burrows into and feeds upon the interior of the stems; the Grougrou Worm, the larva of *Calandra palmarum*, Fabr. (which is eaten by some of the creoles and considered a great delicacy); and *Calandra sacchari*, Guilding, the Large Borer. Since the hurricane of

1831 an homopterous insect has shown itself, and multiplying rapidly has committed great ravages; this is *Delphax saccharivora*, Westwood. Two other insects, apparently belonging to the Aphisidæ and Coccidæ, have more recently been highly injurious to the sugar-canes, and others of this class equally infest other plants. The cocoa-nuts are so attacked by an *Aleyrodes*, that when the author quitted Barbados there was not a single healthy tree left.

The list of Crustacea is compiled by Mr. Adam White. Sir Robert Schomburgk believes that, if thoroughly examined, the islands and seas of the West Indian Archipelago would yield probably four times as many species as are at present known, and states that although the marine fauna of these islands is still insufficiently known to enable us to deduce results as to the distribution of the Crustacea, it is Mr. White's opinion that many of the species discovered by Jay and his correspondents on the south shores of the United States will eventually be found in the West Indian Archipelago.

The number of Mollusca found in the neighbourhood of Barbados is by no means large, and the author having been disappointed of a list, gives a catalogue of those found both in Barbados and the West Indies in general.

The Fishes, determined by Profs. Müller and Troschel, include a number of new species and one new genus, *Caprophonus*, Müll. et Trosch., belonging to the family Scomberoidei. The Reptilia are sparingly represented in Barbados: the *Iguana tuberculata*, the largest of the Saurians, is now very scarce. Only one snake has been found, and the sight of a specimen is a rare occurrence; it is perfectly harmless, and from the description given to the author, probably a *Tortrix*.

The number of indigenous birds does not amount to fifteen, and there are about forty species recorded as birds of passage, or only occasionally seen on the island. The absence of woods and umbrageous trees is doubtless the cause of this paucity. A British bird, the Ruff Sandpiper, *Philomarchus pugnax*, L., is recorded for the first time as occurring on the other side of the Atlantic. It was sent to the author among other migratory birds, but the communicator, Mr. Bishop, observed that its name was not known; thence it may be inferred that its occurrence in Barbados is a rare circumstance. Our space does not admit of more than this hasty glance over the contents of this book, but we hope that it will be sufficient to convince our readers of the interest attaching to it, and induce them to become acquainted with the details by a perusal of the work itself.—A. H.

Zoological Recreations. By W. J. Broderip, Esq., F.R.S.

A pleasant book on a delightful subject with a pleasing title. This work, which we should have noticed before, consists of a series of papers written by one of our most talented lawyers for the pages of the New Monthly Magazine, from which their author, urged by Professor Owen and other scientific friends, has reprinted them. He has done well in collecting these papers, for he has given us another book belonging to a class far too rare, in which White of Selborne, Knapp,

Waterton, Darwin and Gosse have earned laurels. The chief object of this class of works is to please while they instruct, to enliven as well as to enlighten, to awaken as well as to cherish a love for natural history. Along with Kirby and Spence, and in the same list with Alexander Wilson the American ornithologist, the authors specified above and the writer at the head of this article may be placed.

A popular writer is too often deemed by the mere scientific man, not profound, and there may be at times some truth in it; Mr. Broderip however is not superficially acquainted with some of the chapters of the book of nature. He is well known as a scientific conchologist, whose very fine collection of shells, many of them originally described by himself, were acquired by Parliament for the nation and deposited in the British Museum. His writings and compilations in the Cyclopædia of the Useful Knowledge Society have done much to diffuse a taste for natural history, and in the work before us, leaving for a time strict science, he delights us with many pleasing chapters on birds and beasts.

There are two excellent chapters on our resident and migratory singing-birds, right pleasant reading at this time of year, from the associations they call up of spring and summer. He discourses pleasantly on owls, a grave subject; and from chattering, gay-coloured parrots and parrakeets turns to gobbling turkeys or bubbly jocks, one of which, the ocellated turkey (*Meleagris ocellatus*), he strongly urges some patriotic individual to introduce to this country. The Earl of Derby has one specimen in his noble aviary and menagerie at Knowsley, but we fear that the bird is a widow, and likely long to continue so: it is strange that his lordship has been hitherto unsuccessful in finding a mate for this bird. From swans, wild and tame, which

"on sweet St. Mary's Lake,"

and on other lakes and streams as well,

"float double, swan and shadow,"

our author most undesignedly passes to a chapter of advice to anglers,—a fertile theme, unexhausted and inexhaustible, as witness the writings of Izaak Walton, Sir Humphry Davy—how Walton would have *loved* the chemist, and the sculptor Sir Francis Chantrey, even although he wrote no 'Salmonia'!—of Mr. Yarrell, of Scrope, of John Wilson (the renowned Christopher North), of Jesse, *cum multis aliis*—"Good luck to your fishing:" there seems to be some free-masonry in the *thing* itself, and there is certainly something most attractive in the *subject*.

Whether the spring-filled song on the bonny month of May in page 172, immediately after the "Word to Anglers," be the buoyant spirits that flow from the subject just touched upon, we know not, but the five stanzas come in most opportunely and read most pleasantly. We have not got half through the book, and must leave dogs and cats, (surely Mr. Broderip, like Jeremy Bentham, is a bachelor,) apes and monkeys, and the grave, gigantic and graphically described elephants, for another notice; with three chapters on Dragons, Mr.

Broderip concludes his volume. How happy are we that we live in days when these monsters are doomed to lie petrified in oolitic rocks or extended, carved curiously "by art and man's device," out of the solid stone, and gazed at, in and through glass cases, in the National Museum! The work of Mr. Broderip is very readable, and it would prove instructive to many a scientific man, as well as amuse his leisure hour. We have no doubt that this work will "cherish," as well as "awaken, a love for natural history."—A.W.

An Experimental Inquiry into the Cause of the Ascent and Descent of the Sap, &c. By G. Rainey, M.R.C.S.E.

Whatever may be the value of these inquiries, it is certain that they have led the author to some conclusions which will appear rather curious to most botanical anatomists. For instance, he endeavours to show that the crude sap ascends in the substance of the cell-walls and intercellular matter without passing through the cavities of the cells or vessels, and his reasons are founded upon the experiment of causing plants to imbibe certain solutions and then decomposing these in sections placed beneath the microscope, when the solid walls alone exhibit the coloured product (!). If we were to strain a solution of bichloride of mercury through a piece of gauze, and then to decompose this by hydrosulphate of ammonia and to examine the gauze by a magnifier, it is probable that we should find the *substance* alone coloured, but we should hardly deduce from this that no bichloride of mercury had passed through the interstices.

The author's way of accounting for the formation of vessels is equally original; he shows that "the wall of a vessel is formed by the union of the external thickened wall of the surrounding cells."

The various experiments and details respecting the movement of the sap and the growth of plants offer nothing of value which is not already well known.

In these days it is absolutely necessary that students of a science should make themselves *clearly* acquainted with the results of the labours of their predecessors: had the author of the present little volume done so, he would have saved much valuable time and application.—A. H.

MISCELLANEOUS.

Extracts from a Letter to Thomas Bell, Esq., F.R.S., *from* George Clark, Esq., *of Mauritius.*

Port Louis, June 5th, 1847.

* * * "I venture to lay before you the following description of some bullocks, brought hither from the island of Lombach, near Java. One cargo only has been imported, and it does not appear likely that any more will be brought. Their characteristics are so novel to me that I determined to describe them to you.

"Their heads are lighter and more deer-like than any of the Ox tribe I have before seen, with the eye remarkably full and lively, but still gentle. The callosity on the muzzle is narrower than that of ordinary cattle, and extends farther upwards towards the forehead. The horns are of moderate size and prettily curved, and furrowed longitudinally as well as transversely at the base, giving almost the appearance of the butt of those of the stag. These oxen are of middling size, but have an amazing depth of chest, and considerable width between the fore-legs: very little dew-lap; no hump; but the spinous processes on the side of the hump so elongated as to give the idea of a hump having been dissected off. Legs remarkably clean and of moderate length, and so formed as to indicate great strength and activity. Buttocks full and square behind. Tail remarkably fine and tapering to a sharp point, with a moderate tuft of hair. An oval mark of a yellowish white colour begins at the root of the tail and descends nearly to the hocks, including both buttocks; the length of this mark is to its breadth as 5 to 3. The skin extremely fine and soft, with a coat like that of a race-horse. Colour varying, but very few pied and none quite black; a light bay predominating, in some individuals beautifully marked with small white spots. These characters belong to the whole cargo, about ninety in number, and are not therefore to be considered as individual peculiarities.

"The animals were all very gentle, and their appearance, from the form and lightness of the head and the lively mildness of the eye, was superior in beauty to that of any lot of cattle I ever saw.

"The captain who brought them informs me that the natives would not part with their cows, and every one of these of which I speak was castrated. Having been put in a cold shed after landing, many of them got ill, and some died; and as we have suffered terribly from a murrain which visited our cattle two or three years ago*, these oxen were almost all bought for slaughter, as the planters fancied the disorder which attacked them to be something belonging to the breed. I only know one pair surviving, and they work admirably well, being as active as Devonshire oxen. I send you a pair of the horns, but unluckily forgot to send a skull till it was too late to obtain one. The beef was very fine-grained, but of a darker colour than usual.

"I have lately seen it remarked that cross-bred animals, though possessing some advantages, are generally inferior in stamina to those of unmixed breed, and more liable to disease; such observations as I have been able to make fully bear out the truth of this position. We have here many Timor ponies, as well as from Java; and their powers of endurance and exemption from disease are far superior to those of Cape or European horses. The Timor are very light but wiry, seldom reaching 13 hands high; they are spirited and active, rather low before, and are very sure. The Java are larger and stouter, many reaching 13 and some 13½ hands; these generally carry the head and tail very high, and are safe and fast. The most valued

* See Annals, vol. xv. p. 141.

of all however are the Burmese, or more correctly the Pegu ponies; these are universally of the cob make, with great carcase, thick necks and short strong legs; they are very easy for the saddle, generally ambling, and are very safe, fast and enduring: their great power renders them excellent for four-wheeled carriages; and it is not uncommon to see one of them 13 hands high draw with ease a carriage that would be a good load for an ordinary horse of 15: their chief defect is their impetuosity, which is excessive. This breed is particularly mindful of ill-treatment, and a person that has once misused one will seldom be able to do anything with him afterwards. They are of various colours, but I never saw a black one: the prevailing colour is gray, most beautifully dappled. They all have that peculiar fulness at the throat which belongs to the horses in ancient Grecian sculpture. Mares or stallions of this breed cannot be procured at any price whatever. A captain with whom I am intimate, a proprietor at Moulmein, assures me of this fact, which I have also heard from many others. No bribe would induce a native to expose himself to the certain torture and death that would follow a violation of this law.

"I am decidedly of opinion that geldings stand work quite as well as entire horses here, and some of those persons most competent to judge concur with me. These Pegu ponies are a striking instance of the fact.

"I do not know if you are aware of the amazing fecundity of the 'Tanree*,' which is very abundant here. They sometimes produce as many as twenty-two young at a birth; and from twelve to eighteen is their usual number. Their appearance is much like that of the hedgehog, and like those animals they hybernate in the dry season. As far as I can learn they are altogether insectivorous. They are far from being of so pacific a nature as the hedgehog, for they bite hard and hold on with great tenacity. The female when followed by her young will turn and face a pursuer with angry gruntings till her little ones are in safety. They are a favourite dish with the lower orders here, and are generally split down the back, after being singed like pigs, and are then smoked. They are usually fat, but the only one I ever tasted had a rank flavour that was by no means agreeable. They are not indigenous here, having been introduced from Madagascar; but they are very numerous, notwithstanding their being destroyed in immense numbers for food."

HABITS OF INSECTS.

Philosophical Hall, Leeds, Dec. 15, 1847.

Dear Sir,—I know not whether the two accompanying scraps will be worth a line in the 'Annals of Natural History.' The first is a case affording an illustration of the powers which the Arachnida possess of sustaining life when deprived of food.

* This must be the *Centetes setosus*, which appears to be the only species introduced into Mauritius.—T. B.

In July last I had a large specimen of *Ixodes* brought me, taken from off a West Indian tortoise. I put it into a pill-box, and having left home for a few weeks in the autumn, it was completely forgotten. Last month however (November) I happened to open the box, when I found the specimen still alive, though languid and shrivelled in appearance, accompanied by a strange-looking mass larger than itself, which upon examination proved to be an immense number of orange-coloured eggs, resembling a portion of the roe of a fish, but more minute in structure. This day I found the parent dead, but the eggs I think appear to have increased in size; whether they are likely to produce any young is still to be seen. At the lowest calculation the animal had lived four months without food.

My second is an instance either of affection or loyalty, I cannot tell which. In one of my colonies of ants, a small black one, the queen (which is as large as six of the workers at least), died a fortnight since from some cause, and lies in one of the passages of the formicary. But up to this day there has been constantly several workers attending her remains, occasionally touching her with their antennæ and striking her with their heads (an action common with this species of ant on meeting each other, which I have not observed in any other families). A few days since I poured some water into the nest, to see if it would cause the guards to forsake their charge, as water generally causes a dispersion when it suddenly enters their passages; but in this instance, although it threw them into some confusion, they would not leave the body of their queen. Is this affection? I remain, dear Sir, yours respectfully,

HENRY DENNY.

Richard Taylor, Esq.

NOTE ON THE INSECTS OF MADEIRA.

We make the following extract, by permission of Mr. W. Thomson of King's College, from a private letter addressed to him from Madeira by our correspondent, T. V. Wollaston, Esq., of Jesus College, Cambridge :—

"The country here is most glorious; mountains rising 7000 feet towards the moon, and Funchal at the bottom of them, 'looking at itself' in the sea: the intermediate space filled up with wood and rock, and for the last 1000 feet with vineyards arranged on terraces and the country-houses of the 'aristocracy' of Funchal. The vegetation is grand to an excess: grapes, oranges, bananas, figs, pumpkins, guavas and prickly pears in actual profusion, with geraniums, cacti, fuchsias, myrtles, cassias and heliotropes spread over the country like weeds. The hills are tremendous, involving the necessity of keeping a horse, which is sometimes 'too large a specimen to be convenient' in entomological researches. Insects are themselves scarce here; so I have been driven to collect all orders alike, and muster 230 species, or 970 specimens; and as I have been here only six weeks, this will at least show you that entomology is still cherished, though under adverse circumstances and many local disad-

vantages. I have been working chiefly at Coleoptera, Diptera and Hemiptera, and find them more abundant than the other orders. *At present* (25th Nov. 1847) my numbers stand thus: Coleoptera, 87 species; Diptera, 43 species; Hemiptera, 39 species; Hymenoptera, 25 species; Lepidoptera, 20 species; miscellaneous, 16 species."

This is certainly far above any published list of the insects of Madeira, and we have no doubt that our talented correspondent, Mr. Wollaston, of Jesus College, Cambridge, when less of an invalid, will add much to it. As it is, it will doubtless prove interesting to the entomologists who read this Journal.—A. W.

CURIOUS PHÆNOMENA IN THE NIGHT-BLOOMING CEREUS, &c.

Highgate, 11th Dec. 1847.

My dear Sir,—Two days ago a remarkable circumstance occurred in my greenhouse, which it may be interesting to you to communicate. The *Night-blooming Cereus*, of which I gave you a cutting, has long had a bud. Being a fine strong plant, it has been able to mature it even at this unusual season. It arrived at maturity on *Thursday*. The days however not being of the length usual at its ordinary season, it seems to have been somewhat puzzled how to bloom. When I entered my greenhouse at 8 A.M. I found all the petals on *one* side expanded [left side]. I thought this remarkable, but conceived that, in this dull weather, a longer effort at opening was necessary than usual. I watched it all day, but was surprised to find no advance. At 8 P.M. I went into my greenhouse for the express purpose of examining the bloom, when, to my great surprise, I found that *all the petals which had opened in the morning were closed up*, while all the petals of the *opposite* [right] side were then *fully expanded*! The left petals remained closed. The bud was a full-sized and healthy one. [The seed promises to mature. 27th December.]

It is obvious, I take it then, that the law which regulates the opening of these flowers, and which normally causes them to bloom at *night* only, and *for* [say] *twelve hours* only, affects the *individual* petals and not the totality of the bloom. Hence if, from any accident, as here, any number of petals mistake a dull day for the night, and open, their doom is sealed: they have begun their twelve hours' race, and can see it—and *no more*; and their more knowing companions, who keep closed till true night, must flourish alone in their glory,—but *will* do it, independent of the prior blooming and present decay of their companions.

I have often noticed that if the *Echinocactus Eyriesii* (a remarkably rapid bloomer) advances to the point of opening near morning, it remains in that exact state all the day, checked by the light, and does not begin to burst till the sun is going down.

While on vegetable life I have another curious matter to notice. In the 'Annals,' vol. xix. p. 470, is an article on "Monstrous Roses." A far more remarkable circumstance than any noticed there, or than I ever saw noticed, occurred in my own garden in the same year as the monsters there recorded, and in a plant of the same na-

tural family (*Rosaceæ*). A *Potentilla*, which had for some years been a favourite plant from its great luxuriance of growth and bloom, played in that year, without removal or any alteration of treatment, the following strange antics. As usual it grew luxuriantly and was covered with bud, but it did not bear *a single* true flower throughout the season. Every flower on the plant, without exception,—and none died off,—opened into a tuft of small regular green leaves: it was not a mere whorl of leaves for the petals, but, there being no stamens or pistils, the whole apparatus of the flower was replaced by green leaves of small size in a thick tuft. Sometimes a second would grow, smaller, from the centre of the first flower, but it presented the same aspect. All these leaves were of the same colour and character as the ordinary leaf of *Potentilla*.

I was much interested in observing this plant, and watched it the next spring, but it died after this unnatural effort.

If you think either of the above facts worth recording, you are welcome to them.

I am, my dear Sir, very faithfully yours,

J. Toulmin Smith.

W. Francis, Esq.

Descriptions of two new species of Planaria. By Joseph Leidy, M.D.

Planaria maculata. Superiorly convex, faintly blackish or brownish with irregular colourless maculæ; inferiorly flat, colourless; anteriorly trapezoidal; posteriorly spatulate or oval; eyes two, anterior, proximate, composed of a large semitransparent mass with a reniform mass of pigmentum nigrum at the postero-internal part; oral aperture ventral, one-third the length of the body from the posterior extremity; proboscis large and cylindrical. Length $2\frac{1}{4}$ lines; breadth $\frac{1}{2}$ line. Found in moderate abundance in the ditches below the city, creeping upon the submerged stems of aquatic plants.

Subgenus. *Prostoma,* Dugès. Mouth anterior and terminal.

Prostoma marginatum. Blackish, narrow lanceolate, anteriorly truncate; marginate, margin delicately striate; mouth large; proboscis large and oblong; eyes two, anterior, distant, each consisting of two round masses of pigmentum nigrum in contact with each other, and of which one is larger than the other; generative orifice one-fourth the length of the body from the posterior extremity. Length 1 line. A single specimen found with the preceding, but probably not rare; for, from its small size, it escaped my notice while collecting some of the former, and it was not until I got home that I detected its existence in the vessel of water containing the others.

The anatomy of *P. maculata* does not differ from that of *Planaria lactea*, as given by Dugès in the 'Annales des Sciences Naturelles.' In *Prostoma marginatum* the digestive cavity has not the dendritic arrangement of *Planaria*, but merely consists of a large capacious sac extending as far back as the posterior third of the body, and having a cæcum upon each side of the proboscis. The penis has a yellow colour, and consists of a round granular mass, with a moderately long

and bent spiculum projecting from its posterior part. The arrangement of the female apparatus I failed to trace.—*Proceedings of the Acad. Nat. Scien. Philadelphia.*

PROFESSOR AGASSIZ.

We are credibly informed that this distinguished naturalist has consented to accept an invitation to remain in this country in connection with the scientific corps of Harvard College. Every scientific man in America will be rejoiced to hear so unexpected a piece of good news.—*Silliman's Journal for Nov.* 1847.

METEOROLOGICAL OBSERVATIONS FOR NOV. 1847.

Chiswick.—November 1. Overcast: very fine: clear. 2—4. Foggy. 5. Densely overcast: very fine. 6. Very fine: rain. 7. Cloudy. 8. Fine. 9. Exceedingly fine: clear. 10. Frosty: fine: clear. 11. Fine: cloudy. 12. Rain: fine. 13. Clear and fine: overcast. 14. Overcast: slight rain. 15. Fine. 16. Rain. 17. Fine: clear: sharp frost. 18. Frosty: clear. 19. Frosty: hazy. 20. Dense fog. 21. Foggy: hazy and damp. 22. Overcast: exceedingly fine. 23. Cloudy: rain. 24. Very fine. 25. Cloudy. 26. Constant rain. 27. Foggy: rain. 28. Overcast: rain: barometer very low. 29. Very fine. 30. Rain: cloudy and mild.

Mean temperature of the month	44°·61
Mean temperature of Nov. 1846	43 ·73
Mean temperature of Nov. for the last twenty years	42 ·88
Average amount of rain in Nov.	2·56 inches.

Boston.—Nov. 1, 2. Fine. 3. Foggy. 4, 5. Cloudy. 6. Cloudy: rain P.M. 7—10. Fine. 11. Rainy. 12. Rainy: rain early A.M. 13. Fine. 14. Fine: beautiful morning. 15, 16. Cloudy. 17. Fine: at noon thermometer 43: stormy P.M. 18. Fine: snow early A.M.: first ice this morning. 19. Fine. 20. Foggy. 21. Cloudy. 22. Rain. 23. Rain: rain early A.M. 24. Fine. 25. Windy: six o'clock P.M. therm. 52·5: rain P.M. 26. Cloudy: three o'clock P.M. therm. 48·0: rain P.M. 27. Rain: rain P.M.: half-past six P.M. therm. 48. 28. Rain. 29. Fine. 30. Rain: rain early A.M.

Sandwick Manse, Orkney.—Nov. 1. Cloudy: drops. 2. Cloudy: clear. 3. Showers: clear. 4. Cloudy. 5. Rain. 6. Cloudy: drops. 7. Cloudy: rain. 8. Damp: rain: cloudy. 9. Showers: cloudy. 10. Showers. 11. Bright: clear. 12. Clear. 13. Bright: damp. 14. Rain: cloudy. 15. Bright: showers. 16. Hail-showers. 17. Snow-showers: hail-showers. 18. Drizzle. 19. Drizzle: cloudy: aurora. 20. Clear: cloudy. 21, 22. Cloudy: rain. 23. Showers: sleet-showers. 24. Bright: showers. 25. Cloudy: showers. 26. Showers: cloudy. 27. Clear: frost: rain. 28. Clear: frost: cloudy: frost. 29. Bright: cloudy. 30. Showers.

Applegarth Manse, Dumfries-shire.—Nov. 1. Showers: heavy rain A.M. 2. Very fine. 3. Fair: frost A.M. 4. Dull: slight drizzle. 5. Threatening. 6. Occasional showers. 7. Heavy rain. 8. Heavy rain: flood. 9. Fair and fine. 10. Dull A.M.: rain P.M. 11. Rain all day. 12. Rain A.M.: cleared. 13. Raw: frost A.M. 14. Dull, but fine. 15. Showers A.M.: heavy P.M. 16. Fine A.M.: showers P.M. 17. Frost: ice on pools. 18. Hard frost. 19. Dull: fair. 20. Dull: slight drizzle. 21. Dull: rain P.M. 22. Fine A.M.: rain P.M. 23, 24. Heavy showers. 25. Rain: heavy. 26. Fine A.M.: rain P.M. 27. Fine: frost A.M. 28. Frost: fair. 29. Rain early A.M. 30. Showery.

Mean temperature of the month	45°·7
Mean temperature of Nov. 1846	44 ·4
Mean temperature of Nov. for twenty-five years	40 ·4
Rain in Nov. 1847	3·79 inches.
Average rain in Nov. for twenty years	3·60 „

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.								Wind.				Rain.			
	Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. Nov.	Max.	Min.		9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9½ a.m.	8½ p.m.								
1.	30·286	30·024	29·79	29·97	29·92	29·80	29·70	65	36	53	56	48	50½	53½	sw.	s.	s.	s.	·01	......	......	·06
2.	30·343	30·305	29·83	30·03	30·28	29·80	30·09	55	43	50	56	52	50	50	sw.	s.	w.	w.	·02	......	......	·07
3.	30·325	30·270	29·88	30·25	30·19	30·21	30·28	50	44	50	50	30	48	41½	s.	calm	ne.	w.	·01	......	......	·20
4.	30·216	30·138	29·77	30·04	29·96	30·11	29·96	50	44	49	51	46	46	47	e.	ese.	e.	se.	......	......	......	......
5.	30·010	29·941	29·62	29·79	29·54	29·73	29·56	56	42	43	55	44	50	49½	s.	s.	se.	sse.	......	......	......	·11
6.	30·021	29·904	29·57	29·71	29·66	29·58	29·54	57	47	51	56	52	51	51½	s.	s.	s.	ssw.	·24	......	......	·22
7.	29·988	29·796	29·44	29·51	29·25	29·32	29·10	61	52	52·5	54	52	52½	50½	sw.	s.	s.	sw.	......	·07	......	·01
● 8.	29·596	29·492	29·12	29·17	29·11	29·38	29·08	61	33	56	58	53	43½	51	sw.	s.	se.	s.	·10	......	0·97	·31
9.	30·176	29·820	29·33	29·50	29·95	29·50	29·83	55	27	47	52½	47	47½	47	nw.	sw.	w.	ssw.	......	......	......	·15
10.	30·281	29·963	29·80	29·88	29·79	29·53	29·61	56	32	47	54	41	51	49½	sw.	wsw.	s.	w.	......	......	......	·03
11.	30·220	30·095	29·74	29·91	29·93	29·95	30·07	55	48	47·5	53½	45	46	44	s.	sse.	nne.	w.	·10	......	......	·15
12.	30·118	30·012	29·55	30·04	30·10	30·07	30·09	55	29	51	47	41½	41	41	w.	calm	n.	s.	·02	·11	......	·04
13.	30·231	30·222	29·83	29·99	30·09	29·92	29·98	54	37	41	51	35	47	48½	w.	calm	n.–w.	wsw.	......	......	......	......
14.	30·265	30·242	29·84	30·04	29·98	29·96	29·98	55	44	46·5	54	44	50	48	sw.	calm	sw.	w.	·01	......	......	·11
☽ 15.	30·220	30·201	29·70	29·92	29·84	29·86	29·66	59	46	57	56	53½	47½	46	sw.	calm	sw.	wnw.	......	......	......	·01
16.	30·197	30·157	29·69	30·00	30·00	29·72	29·86	53	33	51	56½	40½	41½	38½	n.	calm	w.	nnw.	·09	......	1·17	·25
17.	30·217	30·061	29·68	30·08	30·30	30·20	30·36	43	30	37	42	32½	37½	37	n.	n.	nnw.	nnw.	·01	......	......	·39
18.	30·372	30·316	30·00	30·30	30·20	30·14	29·95	42	19	34	41½	26½	43	50	n.	calm	sw.	w.	......	......	......	·08
19.	30·369	30·296	30·00	30·16	30·12	29·93	30·00	42	23	35	48½	36	52	51	nw.	calm	sw.	wsw.	......	......	......	·02
20.	30·215	29·444	29·80	30·00	29·82	29·90	29·67	42	36	43	47½	44	48	49	nw.	calm	sw.	sw.	......	......	......	......
21.	29·836	29·593	29·50	29·53	29·14	29·53	29·21	42	37	41	48	45	45½	45	n.	calm	se.	sse.	·01	......	......	·06
○ 22.	29·646	29·570	29·21	29·37	29·04	29·40	28·81	50	35	41·5	57	40	41	43	w.	calm	sw.	s.	·01	......	......	·61
23.	29·964	29·534	29·23	29·28	29·48	29·01	29·20	56	28	46·5	50	38	42	43	nw.	calm	sw.	sw.	·18	·27	0·05	·50
24.	30·126	30·037	29·61	29·53	29·63	29·41	29·56	54	44	41	50	39	42	42	sw.	w.	sw.	sw.	......	·19	......	·30
25.	30·069	29·925	29·61	29·59	29·50	29·47	29·38	52	43	48	53½	43	45½	40	sw.	sw.	sw.	ssw.	·04	......	......	·07
26.	29·861	29·483	29·48	29·55	29·44	29·44	29·39	45	39	43	46½	38½	40½	39	s.	calm	sw.	s.	54	·09	......	·16
27.	29·226	29·143	28·96	29·25	29·19	29·40	29·21	49	41	47·5	42	33½	38	40½	e.	sw.	ne.	ssw.	·17	·04	......	......
28.	29·141	28·908	28·75	28·91	28·90	29·04	29·00	50	29	47	38	29	34	36½	s.	calm	n.	......	·04	·53	......	·09
☾ 29.	29·699	29·342	28·93	29·05	29·38	29·06	29·22	50	31	40	45	33	42½	41½	sw.	w.	wnw.	s.	·02	......	......	......
30.	29·826	29·720	29·28	29·29	29·58	29·13	29·32	56	35	51	52	41	46	43	sw.	w.	w.	w.	·04	·02	1·60	·15
Mean.	30·035	29·865	29·55	29·722	29·710	29·650	29·622	52·33	36·90	46·1	50·5	41·4	45·35	45·21					1·66	1·32	3·79	4·15

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

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VIII.—*On* Anacharis Alsinastrum, *a supposed new British Plant.* By Charles C. Babington, M.A.; *with a Synopsis of the species of* Anacharis *and* Apalanthe. By J. E. Planchon, doct. ès sc.*

[With a Plate.]

Before describing the plant to which this paper more especially refers, it is desirable to state the reasons which have caused the adoption of the generic name *Anacharis* rather than *Udora*. By the kindness of Sir W. J. Hooker I have had an opportunity of examining the numerous specimens of plants referable to these and allied genera preserved in his Herbarium in company with my friend Dr. Planchon, its efficient Curator; and I take advantage of this opportunity of acknowledging my obligations to him for the very liberal manner in which he has placed his manuscript notes at my disposal. In Richard's Memoir upon the Order *Hydrocharideæ*, where the genera *Elodea* and *Anacharis* were characterized, only the male flowers of the latter are described and figured. In the Herb. Hooker. there are male and female specimens, collected by Tweedie in La Plata, which agree well with Richard's description of *Anacharis* (*callitrichoides*) taken from Montevideo specimens of the male plant. They differ from Drummond's Saskatchawan *Udora* (*A. canadensis*, Planch.) by having petals to the male flowers, and their sheaths less inflated: it seems probable that this is the *Elodea canadensis* of Michaux, who (or Richard) has apparently been misled to consider it as of the genus *Elodea* by the very great resemblance of its female flowers to the hermaphrodite flower of *E. guyanensis*. Indeed, in the absence of the males, the female flowers of some species of *Anacharis* (*A. Alsinastrum* for example) might well pass for hermaphrodite flowers from which the anthers had been accidentally removed: the female flower of *A. Alsinastrum* differs from the hermaphrodite flower of *E. guyanensis* (Rich.) solely by wanting

* Read before the Botanical Society of Edinburgh, 9 Dec. 1847.

the anthers (the filaments existing), and in the somewhat differently shaped stigmas; in these respects agreeing with Nuttall's description of his genus *Udora*. It would seem from these facts that Richard's *Anacharis* is the male of Nuttall's *Udora*, in which genus also *Elodea canadensis* (Michx.) must probably be placed.

It should be observed that the 'Fl. Boreali-Americana' was published, from his father's notes, by the younger Michaux in 1803, and that as the genus *Elodea* is found there, it would appear that he is the true author of the name, and that the *E. canadensis* is therefore a triandrous plant. But the name *Elodea* is expressly claimed by Richard (Mém. de l'Instit. 1811, Pt. 2. p. 4) in these words: "genre encore peu connu, et auquel j'ai donné le nom d'*Elodea*;" and as it is well known (as I learn from Dr. Planchon) that Richard greatly assisted the younger Michaux in the preparation of his work, although he did not allow his name to be placed on its title-page, there can be no doubt that this genus was named and described by him. This will account for the North American plant being placed in Triandria, not Diœcia; for *E. guyanensis* is triandrous, and the look of the plants is so similar, that Richard might well be led to consider *E. canadensis* as of the same structure when inspecting dried specimens alone. Of the hermaphrodite structure of *E. guyanensis* Richard had convinced himself by seeing it alive in its native waters, and it is highly probable that he saw only the female flowers of *E. canadensis*, with three barren filaments, and considered them as hermaphrodite.

I need scarcely remark, that *Anacharis* (1811) is by far an older name than *Udora* (1818), and that as it has been shown, it is hoped conclusively, that they are synonymous, the former must be employed. Nuttall does not seem to have seen Richard's original paper (Mém. Inst. 1811, Pt. 2), for he quotes a figure of the seed from the 'Annales du Muséum,' where a copy of that part of the plate of *Elodea* is inserted. Had he seen the memoir itself, he would doubtless have identified his plant with the genus *Anacharis*, and not have conferred a new name upon it.

In the Hookerian Herbarium a plant is preserved collected by Schweinitz in the United States of America, which Dr. Planchon has determined to belong to the genus *Elodea*, Rich., but as that name is employed elsewhere, he proposes to name it *Apalanthe Schweinitzii*.

The genus *Anacharis* may be characterized as follows:—

Anacharis, *Richard*.

Flores dioici. *Masc.* Spatha tubulosa, ore inflato bifido, uniflora; flore pedicellato. Perianthium sexpartitum, laciniis exterioribus

calycinis ovato-oblongis; interioribus petaloideis linearibus, aut nullis. Stamina 9; filamenta basi in columnam brevem connata; antheræ oblongæ, basi affixæ, loculis connectivo angusto sejunctis. —*Fem.* Spatha tubulosa, ore paululum dilatato bifido obliquove, uniflora. Perigonii tubus filiformis, elongatus; limbus sexpartitus, laciniis ovalibus, conformibus, exterioribus calycinis, interioribus petaloideis. Staminodia tria, laciniis exterioribus opposita, subulata; antheræ nullæ. Ovarium inferum. Stylus setiformis cum perigonii tubo connatus; stigmata tria, bifida vel emarginata. Bacca subtrigona, unilocularis, oligosperma.—Herbæ perennes (vel annuæ, *Rich.*)*, aquaticæ, caulescentes, radicantes. Folia verticillata vel opposita, sessilia. Spathæ axillares.

Anacharis, *Rich. in Mém. de l'Institut,* 1811, ii. p. 61. t. 2 (mas).
Udora, *Nutt. Gen. N. Amer. Plants,* ii. 242.

A. Alsinastrum (nov. sp.?); foliis ternis ovali-oblongis obtusis subtilissime serrulatis, spatha floris masculi (ignota), floris feminei tubulosa ovarium sessilem pluries superante apice bifida, perigonii laciniis latis subæqualibus, stigmatibus ligulatis reflexis emarginatis.

Hab. In ponds connected with the canal at Foxton Locks near Market Harborough, Leicestershire, where it was discovered by Miss Mary Kirby, flowering sparingly, at the beginning of September 1847.

Plant submersed; stem solid, round, semitransparent, several feet long, branching at irregular and distant points, clothed throughout with whorls of leaves. Leaves three (rarely four) in each whorl, oblong, 3–4 lines long, $1\frac{1}{2}$–2 lines broad, obtusely-pointed, minutely and closely serrulate, diaphanous, formed throughout (a continuous semitransparent midrib excepted) of longitudinal rows of small oblong green cells, of which the two or three marginal rows are colourless and quite transparent; edge furnished with very minute closely-placed (except towards the base, where they are altogether wanting or very distant) spinulose teeth pointing forwards; end formed of two curves meeting at an obtuse angle and tipped with a spinous point similar to the marginal ones; uppermost leaves blunter than the lower ones, and often quite obtuse; all spreading at right angles from the stem, their extremity rather reflexed; lower internodes about as long as the leaves, lowest much longer and with opposite and short

* *A. callitrichoides,* Rich., is expressly stated by that author to be annual, our plant is undoubtedly perennial. In a growing plant, now (Dec. 22, 1847) before me, the old stem is losing its leaves, which have nearly all decayed and fallen off, and appears to be itself on the point of death, but several clusters of young shoots have sprung from it, at the base of which roots are produced. In the spring each of these clusters will probably appear to be an independent young plant. This may account for the supposed annual duration of some of the species.

leaves, upper scarcely half their length; the node marked by a transverse dull red line. Roots long, threadlike, diaphanous, from the points at which branches have sprung.—Female flowers from the axils of the upper whorls, solitary. Sheaths sessile, solitary, linear, slightly enlarged at the end, deeply bifid. Flower sessile; tube very long (so as to reach the surface of the water), filiform; limb six-parted; divisions oval, similar, three exterior, three interior rather narrower and more acute. Filaments three, subulate, without anthers. Style adnate to the tube; stigmas ligulate, reflexed, notched, fringed.—Male flowers unknown.

A. Nuttallii (Planch.), *Udora canadensis* (Nutt.), from New Jersey, closely resembles this, differing in the acute termination of its leaves, and apparently its less deeply divided sheath: its flowers are not in a state admitting of examination. *A. canadensis* (Planch.) has lanceolate-linear leaves and a much shorter sheath. The latter differs from the former by not having any inner divisions to the perianth of its male flowers. Our plant is clearly not *A. canadensis*, but it may be *A. Nuttallii*, the want of male flowers totally preventing its absolute determination. As the genus *Anacharis* is, as yet*, confined to the American continent, it has been thought better to give a distinctive name to our plant (derived from its resemblance to *Elatine Alsinastrum*), so as to prevent its being confounded with the American species, and thus extending their range far beyond what may prove to be their natural limits. Should either of them eventually be shown to be identical with our plant, one of the names will of course drop; and as that species to which ours is the most nearly allied is now for the first time distinguished from the *Elodea canadensis* of Michaux, it will then be for botanists to determine which name should be retained.

Shortly after receiving this plant from Mr. Bloxam, I was informed that similar ones had been found in Hampshire and near Dublin. I am indebted to my friend Mr. H. Collins for a specimen from the former locality, an ornamented pond, at Leigh Park, about eight miles from Chichester. He informs me that there is very great probability of its having been introduced there accidentally with the roots of *Nymphæa odorata*, received by the gardener a few years since from America. The plant had not been noticed in the pond previously to those roots being put into it, and it appeared shortly afterwards in small quantity, but soon rapidly increased. Mr. Scott, the intelligent gardener at Leigh Park, has sent three female flowers to Mr. Collins and Mr. Borrer, one of which I have examined carefully. It has three

* The *Udora pomeranica* and *U. lithuanica* of European authors have never been seen in flower, and have much more the look of *Hydrilla* than *Anacharis*, but their genus is at present undeterminable.

broad calycine segments; three narrower, shorter, perhaps spathulate, coralline segments; three broadly linear barren filaments; and two long, greatly recurved, possibly emarginate, stigmas. The upper part of the plant to which one of the flowers is attached is exactly like a similar portion of *A. Nuttallii* from New Jersey, for which I am indebted to Sir W. J. Hooker, and I have no doubt that they are the same species. It is a curious coincidence, that the only perfect flowers of the Market Harborough *A. Alsinastrum,* and also of the Leigh Park *A. Nuttallii* which I have been able to examine, have no trace of more than two stigmas.

Mr. Mackay accompanies specimens of the Dublin plant (found growing in a small pond in the garden of J. D'Olier, Esq., at Collignes near that city,) by the statement that it is in company with *Aponogeton* and other rare aquatic plants, and was in all probability introduced with them. Flowers have not been observed upon it, and its name must therefore remain doubtful—even its genus. In appearance it is almost exactly like *A. Nuttallii,* with which it agrees in having narrower and acuter leaves than *A. Alsinastrum.*

The question now arises, May not the *A. Alsinastrum* have been introduced? To this I answer in the words of the Rev. A. Bloxam, who kindly visited its place of growth and supplied me with numerous living and dried specimens. He says, in answer to an inquiry of mine, "I can find no reason to doubt the *Udora* being a true native. Numbers of other water-plants grow in the same locality, *Potamogetons* of various kinds, &c." He adds, that "although not observed until this year, I should suppose that it must have been a long period in the ponds from the great quantity of it."

Synopsis specierum Anacharidis *et* Apalanthes; *auctore* J. E. Planchon, Scien. Doc.

Anacharis, *Richard.*

1. *A. callitrichoides* (Rich.); foliis oppositis vel ternis linearibus acutis minute serrulatis, spatha pedicello (brevi) cylindrico continua sensim a basi ad apicem dilatata lineari-oblonga apice bifida, antheris (polline emisso) siccitate cærulescentibus, stigmatibus perianthii laciniis longioribus ad medium bifidis; cruribus linearibus.

Hab. in Brasilia australiori; Montevideo, *Commerson*; La Plata (absque loco proprio), *Tweedie* in Herb. Hooker.

A. callitrichoides, *Rich. in Mém. Inst.* 1811, ii. 7. t. 2.

Character e specimine Tweediano, quod floribus utriusque sexus gaudet, masculis, sicut folia, cum icone Richardiano plane congruentibus, femineo unico et pro investigatione nimis imperfecto.

2. *Anacharis Matthewsii* (Planch.); foliis 3–4-nis dense imbricatis, spatha mascula (ante dehiscentiam) breve pedunculata ellipsoidea, perianthii laciniis exterioribus oblongis interioribus linearibus et petaloideis subæquilongis, antheris (novem) subsessilibus polline emisso non cærulescentibus.

Hab. in Peruviæ ditione Ubuamantanga, prov. Canta, *Matthews*, No. 581. In aqua fluente rivulorum.

Folia 7–8 lin. longa, 1 lin. lata, haud acuminata sed apice subrotundato breviter acutata, patentia vel erecto-patentia internodiis pluries longiora. Antheræ lineari-oblongæ.

3. *A. Alsinastrum* (Bab.); foliis ternis ovali-oblongis obtusis subtilissime serrulatis, spatha floris masculi (ignota), floris feminei tubulosa ovarium sessilem pluries superante apice bifida, perianthii laciniis latis omnibus subæqualibus, stigmatibus ligulatis reflexis emarginatis.

Hab. in Anglia.

Folia 3–4 lin. longa, $1\frac{1}{2}$–2 lata, in apice caulis ramulorumque confertis, in parte infima ramulorum parvis distantibus oppositis, sessilia, squarrosa, apice paululum reflexa.—*Babington.*

4. *A. Nuttallii* (Planch.); foliis 3–4-nis oblongo-linearibus subtiliter serrulatis interdum obtusis, petalis floris masculi ligulato-spathulatis, stigmatibus ligulatis reflexis bifidis.—*Nuttall.*

Hab. in America septentrionali, sed loci natales dum stirps cum duobus aliis hucdudum confusa sit, observationibus novis denuo notandi.

Udora canadensis, *Nutt. Gen. N. Amer. Pl.* ii. 242. *excl. syn. Michx.*

Huc fere absque dubitatione refero stirpem prope Novam Cæsaream a cl. Torreyo lectam cujus folia variant late vel anguste linearia, sed tamen sunt semper acutiora quam illa *A. Alsinastri.* Spatha floris feminei sessilis, tubulosa, ovario adpressa et super eum producta, apice acute bifida. Flores pauci et pro examine accurato nimis imperfecti.

5. *A. chilensis* (Planch.); foliis ternis lineari-oblongis obtusis subtilissime serrulatis, spatha floris feminei sessili tubulosa apice hinc fissa, stigmatibus tribus bipartitis perianthii laciniis exterioribus reflexis longioribus.

Hab. in Chili prope Valparaiso, *Cuming*, No. 636.

Folia illis *A. Alsinastri* plane similia, unguicularia, 2 lin. lata, in parte infima ramulorum opposita. Spatha in flore unico suppetente folii tertiam partem vix æquante. Tubus perigonii pollicaris; limbus reflexus, laciniis exterioribus circiter 1 lin. longis, interioribus . . . . . Styli tres, profunde bipartiti, laciniis linearibus.

6. *A. canadensis* (Planch.); foliis ternis lineari-oblongis vel anguste linearibus, apice interdum rotundatis breve acutatis, spatha floris masculi (breve pedunculata) ventricoso-obovata, floris feminei sessilis tubulosa ovarium sub 5-plo longiore apice bifida, perianthii floris masculi laciniis interioribus nullis.

Hab. in America septentrionali. Saskatchawan, *Drummond* (specimina mascula). Canada, *Cleghorn* (specimina feminea imperfecta).

Elodea canadensis, *Michx. Fl. Bor. Amer.* i. 20. ?

APALANTHE, *Planchon.*

Elodeæ sp., Richard. *Udoræ sp.*, Endlicher (sed character genericum ex elementis heterogeneis infauste exstructum).

Flores hermaphroditi, cæterum femineis *Udoræ*, præter antherarum præsentiam, in omnibus conformes. Stamina in specie typica Guyanensi vidi interdum haud æquidistantia, nec cum stigmatibus regulariter alternantia, sed alterum liberum inter stigmata duo, altera duo inter se filamentis plus minus concreta et cum crure altero unius stigmatorum bifidorum semiconnata. Antheras vidi potius late ellipticas quam cordatas; pollinis granula lævia, 3–4-natim cohærentia. Dehiscentia antherarum mihi obscura. *Cl. Bonplandius*, in descriptione *Apal.* (*Elodeæ*) *granatensis*, stylum in collo longo calycis liberum adesse asserit; sed character illud, cum oculatissimum Richardum fugerit, in vivo rursus inquirendum est. Ipse nihil vidi ad confirmationem observationis istæ tendens.

1. *Apal. guyanensis* (Planch.); foliis 3–9-nis lanceolato-linearibus (vel anguste linearibus) a basi ad apicem sensim angustatis acutis haud recurvis, spatha sessili cylindracea "ovarium in ipsa sessile" superante; stigmatibus (sæpius) bifidis: cruribus apice dilatatis.

Hab. in Guyana, *Rich.* Demerara, *Parker*, in Herb. Hook.

Elodea guyanensis, *Rich. in Mém. Inst.* 1811. ii. 4. t. 1.

2. *Apal. granatensis* (Planch.); foliis 7–15-nis, anguste linearibus acutissimis, spatha sessili ovarium in ipsa sessile subæquante.

Hab. in aquis Novæ Granatæ prope Guaduas inter Honda et Cune. *Humboldt* et *Bonpland.*

Elodea granatensis, *Humb. et Bonpl. Pl. Æquin.* ii. 150. t. 128.

3. *Apal. Schweinitzii* (Planch.); foliis sæpius 3-nis (in parte infima ramorum oppositis) lanceolato-linearibus (vel subovalibus) acutis subtilissime serrulatis, spatha sessili cylindrica acute bifida florem demum longe pedicellatum exserente.

Hab. in Americæ septentrionalis provinciis confederatis (United States), loco proprio non indicato, *Schweinitz* in Herb. Hook.

Serpicula occidentalis, *Pursh* ? *Fl. N. Amer.* i. 33 (ob flores hermaphroditos triandros, sed diagnosis manca imprimis quoad floris situm non sufficit).

Herba omnino facie *Anacharidis Nuttallii* vel *A. canadensis.* Folia in ramulorum parte inferiore opposita, abbreviata, subovalia, 2–2½ lin. longa, internodiis multo breviora; cætera linearia, patenti-erecta, internodiis multo longiora ideoque laxe imbricata, acuta nec tamen acuminata. Spatha 4–5 lin. longa. Pedicellus floris 6–8 lin. longus. Ovarium anguste ovatum in collum 1–1½ pollicarem sensim angustatum. Laciniæ perianthii exteriores latiuscule lineares, patentes,

pellucidæ; interiores petaloideæ, tenerrimæ. Stamina tria; filamenta gracilia, antheris longiora; antheræ obovatæ, compressæ, loculis granulis pollinis inter se conglomeratis repletis, dehiscentia ignota. Stigmata tria, bipartita (?), cruribus recurvis perianthii laciniis éxterioribus duplo longioribus.

Obs. Elodea canadensis (Michx.) a specie supra descripta differt, ob verba auctoris in delineatione characteris generici, " ovarium ad caulem sessile." Inde stirps ad *Anacharidem canadensem* (Planch.) verosimiliter recte referta.

EXPLANATION OF PLATE VIII.

Anacharis Alsinastrum, natural size, with a detached flower showing its very long tube.

Note.—The flower, the only one obtained, is doubtless imperfect, by wanting the third stigma.

a. A whorl of leaves.
b. Summit of the sheath.
c. A female flower.
d. Stigmatic fringe.
} Magnified.

We are indebted to Mr. J. W. Salter for the beautiful drawing, made for the 'Supplement to English Botany,' from which our plate is engraved.

IX.—*On the Anatomy of* Eolis, *a genus of Mollusks of the order* Nudibranchiata. By ALBANY HANCOCK and DENNIS EMBLETON, M.D., F.R.C.S.E., Lecturer on Anatomy and Physiology in the Newcastle-upon-Tyne School of Medicine.

[Continued from vol. xv. p. 88.]

[With two Plates.]

Organs of Generation.

FOR the sake of convenience we will treat of these in the following order:—

1st. Male apparatus: testis and penis, and mechanism for intromission and retraction.

2nd. Female apparatus: ovary with oviduct and accessory glands.

3rd. Complementary androgynous organs: spermatheca and its channels.

The generative organs lie for the most part beneath all the other viscera, and occupy the greatest part of the cavity of the body. The ovary at the season of reproduction nearly fills up the posterior half of the body, and the median line divides it into two almost symmetrical parts.

The other organs lie in front of the ovary, and extend as far forwards as the sides of the buccal mass; they are unsymmetrical,

being placed chiefly on the right side, partially covered by the stomach which dips down on the median line between them and the posterior border of the buccal mass; all their outlets leading to a common orifice, which is situated on the right side between the terminations of the rows of papillæ and the margin of the foot, and a short way behind the dorsal tentacles.

This orifice exists at the depressed apex of a small conical nipple or papilla, formed by a projecting and slightly puckered fold of skin, and is readily seen. When this orifice is laid open, a vestibule, or small cavity, is discovered, on the inner wall of which are three perforations, two being easily discovered, surrounded by a wrinkled and projecting border of skin, one directly in front of the other; a third may be detected with some pains among the folds around the posterior opening, and at its anterior part. Of the two openings first mentioned the anterior leads to the male apparatus; the posterior, which is the largest of the three, leads to the female organs; and the third, by far the smallest, leads to the spermatheca. Such is the state of the external parts in their most perfect state of contraction, after death, or in the absence of sexual excitement during life. But during the breeding season it is often found that the vestibule is obliterated by the protrusion outwardly of its inner wall, and then the anterior aperture is replaced, as it were, by a curved conical projection with its concavity posteriorly. This projection is the penis in a partial state of protrusion, and directly behind the base of it is seen the large female orifice, and immediately within this exists the third and smallest opening.

To obtain a complete view of the internal generative organs, it is necessary to remove all the other viscera. The ovary, Pl. III. fig. 1 *d*, is then seen as before mentioned, filling nearly the whole of the posterior part of the cavity of the body. It is of a pale yellow colour, lobulated and granular, broad and thick in front, tapering behind. Its anterior surface is concave, and moulded upon the parts directly in front. These are two large, delicate, semi-pellucid, convex and somewhat rounded lobes of a gland accessory to the female parts, Pl. III. fig. 1 *g g*, which we will call the mucus-gland, since it appears to secrete the mucus-like envelope of the ova, as will afterwards be seen.

These lobes are continuous with each other below, but above there is a deep fissure between them running from behind forwards. At the posterior end of the fissure lies the convoluted part of the oviduct, fig. 1 *f*, which runs forwards into the fissure. Under the convolutions of the oviduct lies the spermatheca with its duct, fig. 1 *h*, *i*. At the anterior end of the fissure, and resting on the front of the right lateral lobe of the mucus-gland, lies a long pale-flesh-coloured much-convoluted tube, fig. 1 *c*, the testis, one

end of which passes backwards into the fissure and communicates with the oviduct, the other enters the apex of a conical projection, fig. 1 *a*, which it will be seen is the retracted male intromittent organ.

Having given the above general notice of the parts as they are seen on being laid bare, and partially drawn asunder, we now proceed to a more particular description of the same after they have been carefully dissected, premising that the description, as well as the general notice, is taken from *E. papillosa*, except where it is otherwise expressed.

1st. Male apparatus : we have already said, that of the external orifices, the male, fig. 2 *a'*, lies in front of the other two. When this orifice is laid open in a specimen that has the parts fully retracted into the body, we find a short canal opening almost immediately into a pretty large sac, fig. 7 *a*, which is nearly filled by a somewhat egg-shaped body *c*, projecting into its interior. The sac at its innermost end is found to be reflected upon the exterior of the contained body, forming a coating for it. When this body is examined by section it displays in its interior a fine tube which is continuous with the testicular convolutions, *d*, at the internal extremity, and at the other opens near the apex, *e*, of the egg-shaped body above mentioned. This body is formed then of a reduplication of the wall of the sac that opens at the external orifice, and contains the termination of the testis towards the exterior. It is capable of being elongated, drawn out to a point, and protruded altogether from the sac that contains it, and the sac itself is also capable of being everted through the external orifice. The contracted egg-shaped body, and the sac in which it lies, on being thrust out externally, assume the form of a much-elongated and finely tapering penis, fig. 5 *a*, inclosing the excretory duct of the testis which opens at its apex. When the parts are contracted, this penis forms the internal conical projection alluded to at the end of the general description.

The testis, fig. 1 *c*. This is a tolerably large tube, intricately convoluted in a somewhat zigzag manner, its coils bound together by a tissue of delicate filaments, and by the branches of the artery and nerve distributed to them, into a pretty compact mass, which lies in front of and upon the mucus-gland, and against the right side of the buccal mass, partly concealing the penis. When the coils are all unravelled we have a tube of uniform diameter, the length of which in one specimen was two inches, being greater than that of the animal itself. It is of a pale flesh colour and opake; and if a portion be removed and examined in the compressorium of the microscope, its walls are seen to be made up of three concentric coats; the two outer are muscular, and their fibres are longitudinal and transverse; the innermost is a secre-

ting membrane, and is lined by numerous corpuscles similar to those in the expressed contents of the tube.

The contents of the tube are easily pressed out, and consist of a tenacious mucus-like matter that contains a great number of corpuscles of different size and appearance, fig. 9. These are chiefly delicate transparent cells, some of considerable diameter, perfectly circular and having a double outline. They are of three kinds: 1st, those which are devoid of contents and of nucleus, fig. 9 *a*; 2ndly, those which present a large granular nucleus, which is either within and lying close upon the wall, or projecting about half their diameter beyond it, *b*; and 3rdly, those which are more or less completely filled with circular, granular and unnucleated corpuscles, *c*; these corpuscles are also seen in considerable numbers, *d*, free, of various sizes and apparently undergoing development into cells.

Spermatozoa have been observed among the contents of the testis of *E. coronata*, though we have not been able to detect any relation between them and the nucleated cells above described.

The tube of the testis after the unravelling of its coils can be traced a short way backwards, along the fissure between the lobes of the mucus-gland, where, after undergoing a sudden and remarkable constriction, it opens into the oviduct where that tube is abruptly bent upon itself, figs. 1 & 2 *k*.

The penis of *E. coronata* when exserted differs from the elongated conical organ of *E. papillosa* in being much bulkier in proportion to the size of the animal, and in its extremity being much enlarged and terminated by an almost circular fungiform membranous expansion, near the anterior border of which the excretory duct of the testis opens. This peculiarity appears to be accounted for by the modified form of the duct leading to the spermatheca in this species, and will be again noticed further on. The testis, fig. 3 *c*, differs also from that of *E. papillosa* in being very short, but of much greater diameter. The constriction at the part where it joins the oviduct is more strongly marked, and prolonged like a small duct. Fig. 8 represents the penis of *E. coronata* retracted within its sheath in the interior of the body.

The penis of *E. Drummondi*, fig. 6 *a*, is similar to that of *E. coronata*, and is given from a specimen preserved in spirits, in which it was exserted. The testis, fig. 4 *c*, is somewhat shorter and thicker.

The male organs of *E. olivacea* resemble those of *E. coronata*.

2nd. Female organs: the position and general appearance of the ovary, fig. 1 *d*, have already been described. On further examination the organ is found to be intersected by a longitudinal median fissure, which can be traced deeply into its substance, and which divides it into two principal lateral masses; smaller

fissures, offsets from the chief one, pass away laterally into the masses subdividing them into numerous lobules of varying form and size. The lobules are connected together by fine filamentous tissue, in which lie the branches of the oviduct and of the ovarian artery. Each lobe is invested by a delicate membrane, and appears to consist entirely of a congeries of ova inclosed within very delicate irregularly-shaped polygonal cells. Pl. IV. fig. 1 *a* represents these cells with the ova at a very early stage of formation; *b*, ova somewhat further advanced; *c*, ova much more highly developed, showing the germinal spot surrounded by the pellucid zone.

The ovary is attached to the skin by what appears to be delicate cellular tissue, and here and there by fine but firm flat bands that seem to be continuous with the inner or muscular layer of the integument. Small tubes, which we think are veins, are also seen passing from the outer surface of the organ into the substance of the skin.

At the front of the ovary, the oviduct, Pl. III. figs. 1 & 2 *e*, resulting from the union of the lesser ducts from all the lobules, is seen to issue from the longitudinal fissure; it is there a minute opake tube, but soon dilates, and passing over the spermatheca is bent upon itself two or three times very acutely, being further considerably increased in diameter, *f*; after this it becomes rapidly diminished in size, e', straight, and continued forwards along the fissure between the lobes of the mucus-gland, and dipping down it receives the constricted part of the testis near *k* as before mentioned, and is then suddenly bent back upon itself. After this it is joined by the duct of the spermatheca, *i*, and the tube resulting from this union turns immediately forwards, and after a short course bifurcates, as is shown at fig. 2 *m*; one branch, *n*, the shorter, dipping downwards, is lost upon the channel belonging to the right side of the mucus-gland, and into which channel it appears to empty itself as the termination of the oviduct; the other and longer branch, i', is continued on to the third and smallest external orifice by the side of the female aperture, and appears to be the channel of the spermatheca. This latter branch we have not been able to trace so satisfactorily as the rest, but have no doubt of its existence as described.

We now come to the large semipellucid or mucus-gland previously mentioned, figs. 1 & 2 *g g*. An analogous organ exists in *Doris* and *Tritonia* which has been described by Cuvier as the testis. It appears on looking first at the upper surface to consist of two distinct glands, but on the under surface these are seen to be perfectly continuous with each other. It is more or less convex on all sides, but the upper surfaces are so inclined towards each other as to leave a deep fissure, in which are lodged, as be-

fore mentioned, the oviduct, the duct from the spermatheca, and the posterior termination of the testis. The whole surface of the gland presents to a certain extent the appearance of the cerebral convolutions of the higher animals; there is however a rounded portion g', seen next the fissure on the upper aspect of the lobes when they are held asunder, that differs from the rest in being opake, granular-looking and of a flesh colour, but more minutely convoluted than the semipellucid portion, yet forming an integral part of it. The semipellucid part of the gland can easily be seen to be disposed in the form of hollow laminæ folded upon each other, and these on the upper surface have a zigzag arrangement. The cavities of the laminæ communicate freely with a wide channel in the interior of each lobe, and these channels unite to form a common tube *b*, which ends externally at the female orifice, fig. 2 b', after having received the termination of the oviduct *n*. This gland we believe not to be the testis, as Cuvier and his followers supposed it—for it has no direct connexion with the male parts—but to be the organ which secretes the transparent glairy matter that envelopes the ova previous to their passing from the body, by which they become attached to the substances on which they are deposited, and which protects them from injury during their evolution. On examining the secretion of this gland by the microscope we found no spermatozoa, but instead, a tenacious granular-looking fluid, with broad nucleated granular scales of what seemed to be pavement epithelium.

The ovary and other female parts do not appear to differ materially from the above description in *E. coronata, E. Drummondi* and *E. olivacea.*

3rd. Androgynous apparatus: the spermatheca, figs. 1 & 2 *h*, lies in front of the ovary between the two lobes of the mucus-gland, and is almost concealed from view by them and by the dilated convoluted part of the oviduct. It is a globular or pyriform sac, of a dirty olive colour, having one or more accessory sacs, *j*, attached to its duct; its walls are thin, but strong and muscular. In *E. papillosa* and *E. coronata* it has been found crammed full of a mass of fully-developed spermatozoa and corpuscles. The spermatozoa, fig. 10 *a* & *b*, consist of a narrow elliptical transparent head often bent upon a long slender tail or filament, which is seen to be either straight or waved, or spirally rolled upon itself. The corpuscles, *c*, are small, elliptical, and varying in size, many of them having a transverse band, others a cross upon them, apparently indicating a tendency to split into two or four parts as represented in the figure.

The duct of the spermatheca, *i*, comes off from the under and anterior part, and after a very short course forwards empties itself into the oviduct at *l*, fig. 2, appearing to end there, but in

fact continued on in union with it to the bifurcation *m*, where it separates from it as the smaller branch which goes on to the external genital orifice.

In *E. coronata*, *E. Drummondi* and *E. olivacea*, the female parts we have seen agree with those of *E. papillosa*; the male parts we have shown differ materially, and the androgynous apparatus again presents corresponding modifications in these three species.

The spermatheca in *E. coronata*, fig. 3 *h*, is a simple elongated pyriform sac without any accessory.

In *E. Drummondi* it is a sacculated bag. The ducts connecting the spermatheca, the oviduct and testis together in these species have the same disposition as in *E. papillosa*, but the duct which leads from the spermatheca to the external orifice is very much modified. It begins externally by a large orifice leading into a short wide channel with thick and wrinkled walls, figs. 3 & 4 $j' j'$, into the side of a strong globular sac *j j*; from the opposite part of this sac issues a minute canal $i' i'$, which returns along the external wall of the wide channel, and approaching the testis near its union with the oviduct, passes under it and between it and the penis, and then after a short tortuous course backwards it unites with the duct of the spermatheca near *i*, a little *above*, and not, as in *E. papillosa*, *below*, the junction of the latter with the oviduct.

The great size and peculiar modification of the external portion of the channel just described has reference obviously to the modified size and form of the intromittent organ in these species. We feel little doubt that the penis passes along the wide channel into the globular sac, which from its size and form is well-adapted to receive and probably to retain the expanded extremity of that organ.

This part of the apparatus is then a peculiar vagina; it is possible that a small point may be protruded from the orifice of the penis, fig. 6 *c*, at the time of conjunction; but whether this be so or not, we believe that the seminal fluid is conveyed along the minute channel, fig. 3 $i' i'$, we have noted as passing off from the vaginal sac *j*, and is thus delivered into the spermatheca *h*.

Looking at the remarkable shortness of the testicular tube in *E. coronata*, *E. Drummondi* and *E. olivacea*, in reference to the modification of their copulative organs, we suppose that the deficient development of the essential is compensated for by an increased efficiency of the accessory organs, that a more prolonged union of the sexes is here rendered necessary, and the conditions for this we find in the peculiar form of the penis and the vaginal sac.

In *E. papillosa*, on the contrary, copulation is effected by the

introduction of the elongated, conical and pointed penis, fig. 5 *a*, into the small simple channel of the spermatheca, fig. 2 *i′*, along which we believe it to pass to at least beyond its junction with the oviduct, if not quite to the spermatheca itself. The penis, as represented in the Plate, is from a specimen preserved in spirits, but in the living state this organ is capable of taking a much more elongated and attenuated form.

The way in which fecundation is effected will be understood if we now trace the passage of the ova from the ovary to the external orifice: they pass along the oviduct, fig. 2 *e*, and are detained awhile in the dilated and convoluted part of it, *f*, probably to receive some necessary investment; after this they are conducted forwards to where the testis joins the oviduct at *k*; here they are subjected first of all to the influence of the seminal fluid of the individual itself, for there appears to be little or no doubt that the double muscular coating of the testis, *c*, is capable of driving its contents either outwardly towards the penis *a*, or if required, inwardly towards the oviduct *e′*. Ciliary motion may also assist in determining the flow of the seminal fluid in either direction. The operation of this self-fecundation being thus accomplished in the first instance, the ova are secondly conveyed backwards to the duct of the spermatheca at *l*, where they undergo the action of the semen injected into that receptacle from another animal during the sexual union; afterwards they are carried into the right duct of the mucus-gland at *n*, which is freely continuous with the left duct, and with the common female channel of outlet *b*.

In the wide ducts of the mucus-gland the ova receive their last coating and their peculiar arrangement in it, and lastly they are expelled through the female orifice *b′*, the form of the channel probably impressing upon the continuous strap or cord of mucus-enveloped ova the peculiar form which the spawn of the different species is found to possess.

It will thus be seen that a double impregnation is here possible, and indeed more than probable, considering the anatomical relation of the parts; but whether it be in every instance essential, we are not prepared to state. If the experiments of M. Alex. de Nordmann related in the 'Annales des Sciences Naturelles,' 3me série, tome v. 1846, touching the breeding of *Tergipes*, which we consider a member of the genus *Eolis*, be thought conclusive, it may be deemed that self-impregnation is alone requisite. Since however copulation is observed to take place among these animals frequently and freely, even in confinement in the house, we have little doubt of the necessity of a double impregnation.

On a review of our description of the generative organs in the above-mentioned species of *Eolis*, it appears that these organs

bear a good deal of resemblance to those of the other Nudibranchiata as described by Cuvier; but in assigning the peculiar functions of the various parts, we differ from that distinguished physiologist. It is however only after often-repeated careful dissection, observation and deliberate consideration that we venture to dissent from such high authority, and we feel it incumbent upon us to state generally in what points we differ, and the reasons of our dissent.

That part in *Doris* called by Cuvier *testis* answers to what we call the *mucus-gland*: that it is not testis we are assured, by its having no direct connexion with the male parts, but opens very evidently into the female channel, of which it is an appendage; we have several times examined its secretion, and found it to correspond exactly with the mucus-like matter that envelopes the ova. Again, the convoluted tube, called by Cuvier *penis*, we believe to be the testis, and for the following reasons:—1st. It is not uncommon to find the true penis, exserted in specimens preserved in spirits: on examination of the parts of *E. papillosa* in such case, the penis of Cuvier is still found in the interior of the body as a closely convoluted tube, the coils of which are nearly all attached to each other by fine filaments, as noticed in our description, and are therefore not susceptible of being unrolled and made to act as an intromittent organ. A small portion however is freer than the rest, and is often found at the base of the penis, being prolonged also to its extremity as the excretory duct of the testis. 2ndly. Its internal structure and its contents are clearly those of a glandular organ, and spermatozoa have been found in it in *E. coronata*; and lastly, its connexions as already pointed out, namely with the penis at one end and with the oviduct at the other, seem to indicate pretty accurately its character.

The sac we have called *spermatheca* we have ventured so to name, because we find it possesses a channel of communication with the exterior and a direct connexion with the oviduct, besides containing, as we have witnessed in *E. papillosa* and *E. coronata*, abundant masses of densely packed spermatozoa. This organ is doubtless the "*vessie*" of Cuvier.

In passing from the Baron's description of the genitalia of *Doris*, while we are glad to acknowledge that his plates and descriptions have been of great service to us in confirming in many points the result of our own dissections, we cannot help being surprised that two other anatomists, who have so recently been engaged upon the corresponding organs of some of the *Eolididæ*, have not availed themselves of the store of valuable information accumulated by their illustrious precursor in the same path of investigation in his 'Mémoires pour servir' &c.—we allude to MM. de Quatrefages and de Nordmann. If we turn to the former

gentleman's account of the genital organs of his *Eolidina*, we find it to be very meagre and imperfect. He states at the commencement that these are as simple as possible; we have found them to constitute that part of the organization which is the most complicated and difficult to be understood. The copulative vesicle he mentions, which he thinks analogous to that of insects, and destined to receive and preserve the spermatic fluid of the *same* individual, acting the part in fact of seminal vesicle, and which he is tempted to believe renders the conjunction of two individuals unnecessary, seems to correspond to the spermatheca: the only other parts he mentions, the testis and ovary with their ducts, we find great difficulty in identifying with the parts described as such in our paper. That the congress of two individuals does really take place, we have had abundant proof.

In the latter gentleman's paper on *Tergipes* above-quoted, we have a confused but more detailed account of these organs. The Professor seems to have confounded the testis and ovary together, owing to the action of the compressor; for we cannot believe in the development of spermatozoa in the female parts, and in this we agree with his translator as well as in our conviction that the "*poches séminales*" are parts of a multiple testis. If this be the true interpretation then, we find that in this section of the genus there is a modification of the testis which does not exist, as far as we know, in any of the others. Such a modification we think not improbable, since we have observed a similar conformation in *Chalidis*, a naked mollusk having considerable affinity to the *Eolididæ*, and placed as the lowest genus in M. de Quatrefages' order Phlebenterata. The liver, as M. de Nordmann gives it, appears to be a part of the large mucus-gland we have described. The urinary gland is perhaps the opake granular part of the same. The testis is evidently the spermatheca, from its form and contents. The "*vessie muqueuse*" would seem to answer to the sac of the penis, and the short flexuous canal, which, coming from the *crytalloid* (?) bodies of the foot, enters its posterior extremity, appears to indicate the duct of the true multiple testis.

Organs of Circulation.

These are a heart and blood-vessels.

The central organ consists of auricle and ventricle with valves.

The vessels are arterial and venous.

The heart and the roots of the large vessels lie in the wide cavity of a delicate pericardium, Pl. IV. figs. 2 and 4 *ff, c c*; this is a very fine transparent membrane, difficult of detection at first, which is attached to the aorta just beyond its origin, and to the three great venous trunks just before their union in their common sinus, the auricle. At the same parts its external surface is

attached to the skin, and by means of these attachments the heart and great vessels are secured in their position. The heart and vessels thus inclosed lie free in the cavity, which they fill when fully distended with blood. The heart and pericardium lie above all the other viscera, and immediately beneath the skin of the back, on the median line, and just behind the anterior third of the body.

In *E. coronata* and those species which have the branchiæ similarly arranged, they lie between the second and third clumps.

They form during life a manifest elliptical elevation, more or less transparent, and in which the pulsations may be seen and counted.

On opening a specimen preserved in spirits, the auricle, fig. 2 *b*, is seen at the posterior part of the pericardium, of a cruciform figure, resulting from the union of two large trunks of veins *p p*, coming from the sides of the body with one, *q*, from the posterior part, lying along the median line; the anterior limb of the cross is formed by the contracted portion of the auricle *r*, where it goes forwards to open into the ventricle *a*. The walls of the auricle are quite smooth and polished externally, and within are formed of a very fine but wide meshed reticulation of delicate muscular bundles which are continued upon the greater venous trunks.

At the anterior contracted part is placed a valvular apparatus, fig. 3 *c*, the auriculo-ventricular, to guard the ventricular opening which is on the under surface of the heart.

The auriculo-ventricular valve consists of two flaps continuous at their bases with the walls of the ventricle and prolonged into its cavity, having their ends attenuated and free. They are placed one under and the other over the opening, the former being longer than the latter. They are broad and strong, and when brought together they will effectually close the opening. The opening is wide, and the auricle is attached to its margin at the bases of the valvular flaps.

The ventricle *a*, much smaller than the auricle, is of a pyriform shape, with its apex anteriorly. Its walls are considerably thicker and more fleshy than those of the auricle, and its cavity displays very numerous, strong and bold projecting carneæ columnæ, some of which are attached to the bases and outer surfaces of the valves at both orifices. The interior of the ventricle from its high development reminds us forcibly of that of animals much higher in the scale. The upper half of the organ is much thicker than the under, owing to the superior number and strength of its fleshy columns. The muscular fibres of the auricle and ventricle are devoid of transverse striæ; they are minute, simply granular and rounded.

A valve, the aortic, fig. 3 *d*, is placed at the anterior or pointed

end of the heart; it is a broad elongated lamina, very thin at its free edge, which is slightly semilunar. It projects a long way into the aorta. Its base is continuous with the fleshy columns of the upper wall of the heart, and just above this connexion, and behind the valve, there is a large well-marked sinus at the commencement of the aorta.

The aorta, fig. 2 *d*, begins at the base of the valve, and very soon after perforates the pericardium before giving off any branches.

The elliptical swelling and the transparency observed in the cardiac region during life is mainly owing to the dilated state of the two chambers of the heart. After death the fulness is lost, and the chambers are found contracted and flattened. With some care we have succeeded in a dead specimen in partially inflating the auricle by means of a small blowpipe, so that the parts resumed a good deal of the appearance they present during life. Fig. 4 represents the chambers of the heart inflated, imitating the condition of the parts during life*.

In *Eolis* then we have a simple two-chambered heart, the blood coming from veins into the auricle, passing then into the ventricle, and being thence propelled along the arteries. The pulsations are regular, and their number in *E. papillosa* is upwards of fifty, and in *E. coronata* sixty-five in the minute. The systole of the auricle is followed immediately by that of the ventricle, and during the former action the heart is pulled sharply backwards, during the latter forwards, showing the heart to be free in the pericardiac cavity.

The aorta on emerging from the pericardium gives off a small branch *e*, for the supply of the stomach, and immediately afterwards bifurcates; one branch, the larger, passes forward to supply the anterior parts of the body, the other backwards to be distributed to the posterior parts.

* That what we call the auricle is really such, and not a mere sinus or confluence of veins *branchio-cardiac*, as set forth by M. Milne Edwards in his 'Voyage en Sicile, sixième article, sur l'appareil circulatoire des Théthys,' we believe for the following reasons. It is distinctly divided from the great venous trunks by the pericardium which is evident enough in *Eolis*, and strongly defined in *Doris*: during life, or if injected after death, it presents a well-marked elliptical ampulla within the pericardium, and possesses a pulsation proper to itself, a pulsation that is seen during life to be confined within the bounds of the pericardium, and as if in confirmation of this it is found to be furnished with carneæ columnæ proportioned to the delicacy of its coats.

The branchio-cardiac sinus figured and described by Milne Edwards appears to us to be somewhat anomalous, and certainly differs from anything we have seen either in *Eolis* or *Doris*, and is quite at variance with the corresponding part in the *Tritoniadæ*, of which family it is clearly a member, for in *Tritonia Hombergii* and in *Scyllæa pelagica* the auricle is not longitudinally, but transversely placed, receiving veins from the skin at each end.

The anterior aorta, fig. 2 *f*, passing forwards over the genital organs, and on the right side of the stomach, but on a plane below the ramifications of the digestive system, gives off three or four small arteries, $e' e' e' e'$, to the stomach, and next from its under part a large branch *j*, which after sending off some small twigs is distributed by two or three branches which ramify on the penis, testis, mucus-gland and ducts. The main trunk, after this, is bent down in front of the genital organs, passes under the œsophagus, and becomes applied to the under surface of the buccal mass *n*, on the median line, after having given an offset, *k*, forwards to the anterior part of the œsophagus and upper surface of the buccal mass. Next, about half-way along the under surface of that fleshy organ, it gives off a large artery *l*, which penetrates its floor at an aperture left between the muscular bundles, to supply the tongue and the interior of the mouth: shortly after this, a branch springs on each side from the trunk; these encircle the anterior part of the mass of the jaws just behind the lips, supplying the muscles that connect the mass to the skin, and the skin itself in the vicinity. Lastly, the anterior aorta terminates in three branches near *m*, which are distributed by twigs to the lips and the anterior part of the foot.

The posterior aorta, f', runs a very short way forwards and then turns downwards and backwards, passing under the heart and gastric system; at this turn, and as it runs backwards, it gives off four or five branches to the rectum, which lies on its right side: one branch to the rectum is sometimes given off from the common aorta just after it has perforated the pericardium. The artery then gains the inferior surface of the ovary, among the lobes of which it is at first partially imbedded. On entering this viscus it at once gives off twigs right and left to the contiguous lobes; it next bifurcates, one branch passing on to be distributed by small lateral twigs to the middle and posterior lobes of the ovary, among which they can be seen to subdivide two or three times, accompanying the divisions of the oviduct; the other going to the skin of the foot under the ovary; seven or eight branches come off from it which penetrate the skin, and can be traced a little way dividing in its substance.

Thus we can demonstrate arteries supplying almost all the viscera and a great portion of the skin of the foot, and show that they undergo minute division, and all the branches laid down in our Plate have been verified by repeated dissection: we have failed however in making out their mode of termination. We cannot undertake to say whether they end by closed extremities, or whether they have open mouths which communicate with lacunæ or sinuses in the intervisceral spaces, or with those in the skin. The lacunæ among the viscera we have not been able to make out by dissection, and have not made use of injections

on account of the great difficulty of injecting such small animals, and from a feeling of the unsatisfactory nature of such an operation on tubes so delicate as the minute branches we have observed. The existence however of intervisceral lacunæ we do not wish to deny, since the valuable papers of M. Milne Edwards in the 'Annales des Sciences Naturelles' seem to establish the fact of their presence in nearly the whole of the Mollusca.

The branches of veins coming from the skin, represented in Pl. IV. fig. 2 *s s s s*, have been several times verified; from four to six venous branches have been made out, uniting so as to form two large trunk-veins, fig. 2 $p\,p\,p'\,p'$ and fig. 4 $e\,e\,e'\,e'$, on each side, which joining together pour their united contents at once into the auricle: one of these veins can be seen along the inner aspect of the skin as far forwards as opposite to the transverse portion of the intestine, receiving branches, fig. 4 *g g g g*, in its course from the skin, into which its most advanced branch penetrates; the other and much smaller vein turns backwards, and enters the skin sooner than the former, after visibly receiving a small branch or two from it. Entering the posterior part of the auricle is the posterior trunk-vein, fig. 2 *q* and fig. 4 *d*, which coming from the back part of the skin receives three pairs of branches at least: one pair appeared coming from below as if from the ovary, but was not so distinctly made out as the rest.

If we attempt to trace the veins into the skin, we find that they communicate with a system of sinuses therein. This network of sinuses pervades the whole of the skin, being abundant on the sides under the bases of the papillæ, and on the foot, and we suppose communicates freely with the system of intervisceral lacunæ pointed out by Milne Edwards. Whether the lacunæ of the skin have any thing like a symmetrical arrangement as principal trunks or canals, we have not been able to determine; but if a cross section of a papilla be made, a distinct canal becomes visible at each extremity of the section, as shown in fig. 6 *c c*, and from this and the symmetrical order of the venous trunks passing from the skin to the auricle, we might infer that such an arrangement exists. Those canals run the whole length of the papilla, and communicate with the meshes of a delicate cellular tissue which lines the skin of that organ; at the base of the papilla, they open into the sinuses of the skin. The position of these canals in the papillæ, and the cellular tissue in connexion with them, are indicated in Pl. IV. fig. 9 of our former paper on the digestive system.

The general course of the blood will be necessarily then from the ventricle along the arteries to the viscera and to the skin; in the first case it passes from the arteries, in a way we do not understand, into the lacunæ among the viscera and between them

and the skin, and thence into the network of sinuses in the skin itself, in the latter case into the tegumentary sinuses: in them and in the papillæ into which it is freely admitted; it is more or less perfectly aërated, and thence flows into the veins which pass from the skin to the auricle, and which are called by M. Milne Edwards *branchio-cardiac* vessels. From what we have observed however on attentively examining the connexions of the ovarium, we are inclined to think that the whole of the blood does not circulate in the way above described, for we are pretty sure we have recognized small veins passing away from the sides of the ovarium and entering the skin, and we mentioned above that we had, though indistinctly, made out a pair of veins running from the same organ to the posterior trunk vein that empties itself into the auricle. If these observations be correct, then a small portion of blood is returned to the heart in a way that forms an exception to the general rule, and the existence of veins distinct from the *branchio-cardiac* is established. These veins we presume must carry off from the ovarium to the heart and the skin the blood which has been supplied by the ovarian artery. In confirmation of these observations and of the inference drawn from them, we would add, that Baron Cuvier in his 'Mémoires,' &c. has described and figured in the anatomy of *Tritonia Hombergii* six veins passing from the mass of liver and ovarium into the skin of the side of the body, and conveying the blood to the branchial tufts; and having ourselves seen some time ago in the same animal similar vessels passing also from that mass to the skin, we are the more inclined to confide in the observations of the Baron.

Examinations of the heart of *E. coronata* have afforded the same results as we have detailed with regard to *E. papillosa*. We have succeeded in tracing nearly all the arteries in that species that were observed in the latter; but the venous tubes, from the excessive delicacy and high transparency of the parts, enhanced by the minuteness of the species, have hitherto escaped us. From frequent observations of the above organs in *E. olivacea* and several other species in the living state, we are confident that the circulatory system is as complete in these as in the previously mentioned species.

In M. de Quatrefages' account of the organs of circulation in *Eolidina*, the existence of the venous system is altogether negatived. The incorrectness of this observation we have already sufficiently proved. The two funnel-shaped auricular appendages of the heart described by him have been suggested most likely by a view of the anterior border of the auricle, and by some folding of the auricle itself or of the skin along the median line of the body. It is certain that the auricle is single, and that it

does receive trunks of veins on each side and behind,—trunks that result from the union of numerous venous branches of various size; that it does not communicate directly with lacunæ among the viscera is also certain; and that if we admit the existence of lacunæ, they do not supersede the venous system, but occupy the position of the capillary system of the higher animals. With regard to the arterial system, we can follow M. de Quatrefages with confidence only so far as the bifurcation of the aorta, and have not been able to discover the symmetrical division and arrangement of its branches as described in his memoir and figured in his plate, but we have succeeded in tracing many branches of arteries to a degree of fineness of which that gentleman seems to entertain no idea.

M. de Nordmann describes a ventricle and funnel-shaped processes, but besides these mentions an auricle; in other respects he seems to have fallen into the same errors as M. de Quatrefages: these errors seem due to the exclusive use of the compressor.

Organs of Respiration.

The function of respiration we believe to be performed by the whole surface of the skin, including the papillæ; the skin of the back and of the sides between the papillæ, and the entire surfaces of these latter organs, present the phænomenon of ciliary vibration*. The papillæ we regard as one modification among many of increasing the surface for a respiratory purpose, and thus are to be regarded as a specialized breathing apparatus, to which the rest of the skin is subsidiary.

The skin, Pl. IV. fig. 5, consists of a layer of muscular fibres covered by a tegumentary envelope or cutis that is provided with an epithelium.

The skin varies much in thickness in different parts, being thinnest over the back and on the papillæ, very thick where the papillæ exist; and it here contains near the external surface the ramifications of the digestive system, becomes much thinner suddenly where the papillæ cease along the sides, and attains on the foot its greatest thickness and strength. Its epithelium consists of very small granular nucleated particles, which during life are provided with vibratile cilia.

The outer or dermal layer of the skin, fig. 5 *b*, appears to secrete the abundant tenacious matter that exudes from the animal, and to be the seat of an exquisite sensibility; this layer is thin, but continuous with the next or muscular layer *a*, which

* Having recently, and since writing the above, discovered vibratile cilia covering the whole of the under surface of the foot of *Doris* and also of several of the testaceous Gasteropods, there can be little doubt that they are present also on the foot of *Eolis*.

might be called the cellular from its structure; this it is which varies so much in thickness. Next the visceral cavity there is a thin stratum of longitudinal and transverse fibres; outside of this is the membranous cell-work, containing sinuses that open into the trunk-veins going to the auricle.

The muscular coating in the papillæ is very delicate, and its fibres wider apart than in the rest of the skin, running longitudinally in bundles of two or three together at intervals, and transversely in fewer number and less regularly, as is represented in Pl. IV. fig. 9 of our previous paper.

The cell-work described as existing in the papillæ communicates freely with the system of sinuses mentioned as belonging to the skin of the body, and this system again we have traced to be continuous with the venous trunks leading to the auricle.

Under the compressor of the microscope we have seen, in the cellular layer of the papillæ, the blood move backwards and forwards to and from the base of the papillæ and into the skin, in obedience to the contractions of the body and of the papillary walls; but we believe, that if the animal were at rest and quite free, the action of the heart would also cause similar motions in the normal way. We look upon the contractions of the general integument and of the papillæ to be only accessory, not essential, to the perfect circulation of the blood.

Now the whole or nearly the whole of the blood that passes to the auricle of the heart comes, as we have shown, in the section on the circulatory organs, directly from the skin, and as we know that the blood thus circulating in the skin and papillæ is separated from the oxygenated water of the surrounding sea by a very thin layer, in the papillæ by an exceedingly delicate membrane, we have little hesitation in saying, that it is in the papillæ essentially, and in the rest of the skin secondarily, that the function of arterialization of the blood is carried on previously to the return of that fluid to the heart.

EXPLANATION OF PLATES III. and IV.

Plate III.

Fig. 1. General view of the generative organs of *E. papillosa* partially drawn asunder: *a*, sac of penis retracted into body; *b*, female channel; *c c*, testis; *d*, ovarium; *e*, oviduct; *f*, dilated portion of ditto; *e'*, continuation of ditto towards spermatheca duct; *g g*, transparent portion of mucus-gland; *g' g'*, opake portion of ditto; *h*, spermatheca; *i*, its duct; *j*, accessory glandule; *k*, confluence of testis and oviduct.

Fig. 2. Same organs more fully displayed: *a*, sac of penis; *a'*, male orifice; *b*, female channel; *b'*, female orifice; *c c*, portions of testis; *e*, oviduct; *f*, dilated portion of same; *e'*, continuation of ditto to testis; *g g*, pellucid portion of mucus-gland; *g'*, granular portion of ditto; *h*, spermatheca; *i*, its duct; *j j*, accessory glands; *k*, sudden angle

of oviduct receiving testis; *l*, point of union of oviduct with spermatheca duct; *m*, bifurcation of oviduct into channels going to external parts; *n*, short branch going to duct of mucus-gland; *i'*, long branch to external orifice, being continuation of spermatheca duct.

Fig. 3. Generative organs of *E. coronata* fully displayed: *a*, sac of penis; *b*, female channel; *c*, testis; *d*, ovary; *e*, oviduct; *f*, dilated portion of ditto; *g g*, pellucid portion of mucus-gland; *g'*, granular portion of ditto; *h*, spermatheca; *i*, its duct; *i' i'*, branch from it to vaginal sac; *j j'*, channel from exterior into vaginal sac; *k*, union of oviduct and testis; *l*, junction of oviduct with spermatheca duct; *m*, termination of oviduct in duct of mucus-gland.

Fig. 4. Portion of generative organs of *E. Drummondi*: *a*, sac of penis; *b*, female channel; *c'*, testis; *d*, oviduct receiving testis; *i i*, duct from vaginal sac to spermatheca; *j*, vaginal sac; *j'*, its channel leading to external orifice.

Fig. 5. Exserted penis of *E. papillosa*: *a*, penis; *b*, female orifice.

Fig. 6. Exserted penis of *E. Drummondi*: *a*, penis; *b*, female orifice; *c*, orifice of penis.

Fig. 7. Sac of penis of *E. papillosa* laid open: *a*, cavity of sac; *b*, its orifice; *c*, penis retracted; *d*, testis; *e*, orifice of penis.

Fig. 8. Sac of penis of *E. coronata* laid open: *a*, cavity of sac; *b*, its orifice; *c*, retracted penis; *d*, testis; *e*, orifice of penis.

Fig. 9. Contents of testis: *a*, *b*, *c*, different appearances of cells found therein.

Fig. 10. Spermatozoa: *a*, from spermatheca of *E. coronata*; *b*, two more highly magnified from *E. papillosa*; *c*, corpuscles associated with same.

Plate IV.

Fig. 1. *a*, cells of ovary containing very imperfect ova; *b*, *c*, ova in more advanced stages of development.

Fig. 2. Vascular system of *E. papillosa*: *a*, ventricle; *b*, auricle; *c c c c*, pericardium laid open; *d*, aorta; *e*, artery to stomach; *e' e' e' e'*, small branches to ditto; *f*, anterior aorta; *f'*, posterior aorta removed from body; *g*, ovarian artery; *h*, artery to posterior part of foot; *i i i*, branches to the intestine; *j*, artery to generative organs; *k*, œsophageal branch; *l*, branch to interior of buccal mass; *m*, continuation of aorta to mouth and anterior part of foot; *n*, buccal mass; *o*, œsophagus; *p p*, anterior lateral veins going to auricle; *p' p'*, posterior ditto; *q*, posterior median vein; *s s s*, venous branches to ditto; *r*, point of attachment of auricle and ventricle.

Fig. 3. Longitudinal section of heart of *E. papillosa*: *a*, interior of ditto showing carneæ columnæ; *b*, portion of auricle; *c*, auriculo-ventricular valve; *d*, aortic valve; *e*, aorta; *f*, sinus of ditto.

Fig. 4. Heart of *E. papillosa* inflated: *a*, ventricle; *b*, auricle; *c*, aorta; *d*, posterior median vein receiving lateral branches; *e e*, anterior lateral veins receiving branches, *g g*, from skin; *e' e'*, posterior lateral veins; *f f f f*, pericardium laid open.

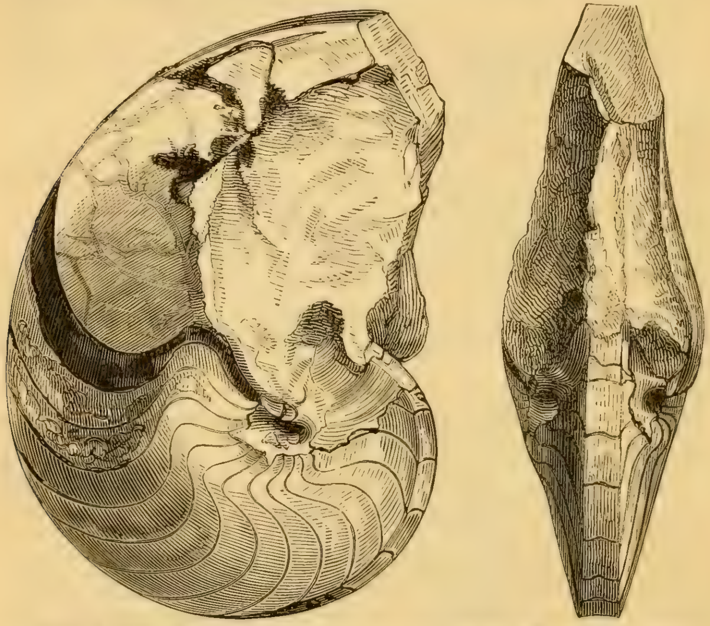
Fig. 5. Section of skin of foot and side of body of *E. papillosa*: *a a*, muscular or cellular layer; *b b b*, dermal layer or cutis with epithelium; *e*, side of body; *f*, foot.

Fig. 6. Transverse section of papilla of *E. papillosa*: *a*, hepatic gland; *b*, duct of ditto; *c*, large vascular canals; *d d d*, cellular tissue around gland.

X—.*Description of a new species of* Nautilus *from the Lower Greensand of the Isle of Wight.* By J. Morris, F.G.S.*

Nautilus Saxbii : *Morris,* 1847.

Testa ovali, compressa, complanata, lævigata, subumbilicata ; dorso plano seu subcanaliculato ; anfractibus compressis ; apertura subtriangulari, vel subsagittata, lateraliter compressa, antice truncata ; septis numerosis valde sinuosis in umbilico flexuosis vel impressis ; siphunculo subcentrali ?



Shell discoidal, smooth, slightly umbilicated, with compressed and somewhat angular volutions, contracted towards the margin, with their greatest diameter near to the umbilicus ; aperture somewhat triangular, laterally compressed, anteriorly truncate, posteriorly impressed or notched by the preceding volution ; back flat, or very slightly channeled in the middle. Septa numerous, nearly equal, the margins very sinuous and rather incurved as they pass over the back ; one sinus very large ; the other, near the umbilicus, small, the intervening saddle placed on the greatest convexity of the volutions. Siphuncle subcentral.

The general form of this Nautilus is like that of *Ammonites Fittoni* (d'Archiac) and *Am. splendens* (Sow.), both of which

* Read before the Geological Society of London, 15th December 1847.

species it resembles in the shape of the aperture. It is also allied to *Nautilus Gravesianus,* d'Orb. (Terr. Juras. t. 38), in the laterally compressed volutions; but that species is furnished with a sharp keel, whereas in *N. Saxbii* the keel is truncated.

The *Nautilus Saxbii* closely resembles the *N. mesodicus* (Quenstedt) *, but differs from it in being of less breadth, having a smaller umbilicus, and in the greater number of the septa.

This shell is readily distinguished from the other lower greensand species by its more compressed form, angular volutions, truncate back and somewhat sagittate aperture, and more sinuous septa; in which latter character it resembles some Jurassic species, as *Nautilus biangulatus, N. sinuatus* and *N. triangularis* of the inferior oolite.

In the individual specimen here described, the last septum is filled with iron pyrites, presenting a contrast to the remaining septa, which are occupied by crystallized carbonate of lime. The body chamber is filled with the sandy matrix of the bed from which it was obtained.

Locality. From the Lower Greensand, at Atherfield, Isle of Wight; in the lowest bed of the "Crackers' group" (No. 4 of the "Table" in Geol. Journal, vol. iii.) †.

This interesting species of Nautilus, which I believe is hitherto undescribed, was put into my hands by Dr. Fitton, F.R.S., to whom it had been sent, with other rare specimens, by S. M. Saxby, Esq. of Mountfield near Bonchurch, Isle of Wight, from his valuable collection of Isle of Wight fossils.

XI.—*Description of an apparently new subgenus of* Calandridæ *from the Philippine Islands.* By Adam White, F.L.S., Assistant Zool. Dep. British Museum.

Calandra.

(*Hyposarothra,* White.)

Antennæ rather strong, springing from a depression situated a little behind the middle of the side portion of the beak, and if stretched out would reach slightly beyond the end of the beak; basal joint nearly as long as the funiculus and last joint taken together; first and second joint of the funiculus

* "Die Cephalopoden des Salzkammergutes, &c. von Franz R. von Hauer" (tab. 10. f. 4, 5). Vienna, 1846.

† In vol. iii. of the Geological Journal the name is *N. Saxbianus.* The genitive termination is here adopted, on Dr. Fitton's suggestion, as according with the other new names (*Ammonites Hambrovii,* &c.) in the "Catalogue" of part of the Society's Museum (Journal, vol. i.).

longer than the other four, which are cup-shaped and all punctured; club fusiform, apparently of one joint, the end slightly pointed.

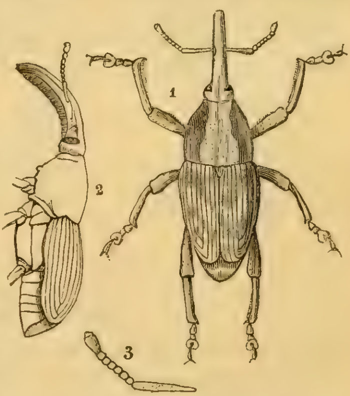
Beak nearly as thick as the head, considerably longer than the thorax, gradually bent and deflexed at the tip, the sides compressed and channeled from before the eye to within a short distance of the base of the mandibles, upper part more or less rounded; the under side, except just at the tip, thickly clothed with close thick-set hairs, much like a tooth-brush, the middle line seemingly with fewer hairs or perhaps free from them.

Eyes largish, oblong, nearly straight behind, somewhat pointed above, slightly rounded in front where the beak comes, and nearly as much separated below as above, the space between them being considerable.

Thorax subovate, convex all round, upper surface behind somewhat depressed, the front part slightly strangulated; scutellum longish, narrow. Prothorax below, just in front of the insertion of the fore-legs, with a prominent dagger-shaped keel.

Calandra (*Hyposarothra*) *imperatrix*, White.

Head and antennæ white, tip of beak black, club of antennæ black, the other joints punctured with brown; of an obscure whitish colour, with seven dusky brownish longitudinal bands on the thorax, one and the widest down the middle, three on each side of the thorax, the intermediate two joined in front; each of the elytra with a large dusky brown patch intersected by a cross, which at the top emits two white branches, connected with the white of the base and sides; pygidium with a large oval patch on the middle, and some brownish dots; the sides of three of the segments of the abdomen with a blackish brown patch; some of the mesosternal plates punctured and marked with a largish pale brown patch.



Calandra (*Hyposarothra*) *imperatrix*.

The femora and tibiæ of each leg thickly furnished on the inside with reddish yellow hairs; legs clouded and dotted with brownish; tarsi with the claws and last joint black. Head and beak above finely punctured, excepting down the middle, where it is smooth. Thorax above with many scattered punctures and

a slightly impressed line down the middle, which runs into a triangular depression in front of the scutellum; scutellum white, without apparent punctures.

Elytra, each furnished with nine deeply impressed lines, the third (from the suture) joined at the tip with the eighth, fourth and seventh joined at the tip, and the third and fourth also joined at the tip and connected with the fourth by a branch.

Hab. Philippine Islands. Mus. Brit.

Elytra considerably depressed above, the base somewhat margined close to the thorax; each elytron with the lateral edge widely sinuated, the end rounded.

Legs strong, the anterior pair close together at the base; tibiæ short, slightly bisinuated within; tarsi with the two basal joints narrow, the second subquadrate and both grooved at the base, the third subrotundate, somewhat widest in front, grooved at the base, and furnished on the sole with very close thick-set hairs.

This subgenus would almost appear to connect the two subdivisions *Cryptopygi* and *Gymnopygi* of the family *Calandridæ* of Schœnherr (Genera et Species Curculionidum, viii. p. 334); with the former it nearly agrees in the position of the antennæ, being about the middle of the beak (which however, as in *Brentidæ* and many *Curculionidæ*, may be only a sexual distinction); with the latter in the pygidium being exposed, or not covered by the elytra. The form may thus prove interesting as one of those links which serve to show how families, subdivisions and genera lapse into each other. In appearance, judging by Schœnherr's description, this in external colour seems to resemble his *Poteriophorus niveus*, iv. 846.

The figure, carefully made, of the natural size, by Mr. Wm. Wing, will show its form, the profile, and also the markings of the only species which was found by Mr. Cuming, F.L.S., at the north end of Luzon in the Philippine Islands in the province of Cagayan.

XII.—*On the Insects of Jamaica.* By Philip Henry Gosse.

The following is a very imperfect list of the Insects collected by me during a residence of about a year and a half in Jamaica: imperfect, because many species seem to be as yet unnamed, and also because many others which I omitted to register with a number, it would now be exceedingly difficult to determine. Imperfect as it is, however, I communicate it, as local lists are always useful to science: and I shall use this one as a vehicle for recording a few scattered notices of individual species, which, though too trivial to form separate papers, may yet, as isolated facts, be worth preserving from oblivion.

I had left England with high expectations of the richness of the West Indian entomology: large and gaily-coloured beetles, I supposed, would be crawling on almost every shrub, gorgeous butterflies be filling the air, moths be swarming about the forest-edges at night, and caterpillars be beaten from every bush. These expectations were far from being realized; a few species of butterflies, chiefly *Pieris, Callidryas, Terias, Heliconia Charitonia, Argynnis Passifloræ,* and *A. Delila, Cystineura Mardania,* and one or two *Nymphalidæ* and *Lycænadæ,* are indeed common enough at all times, and in almost all situations; others are abundant at a particular season or locality; but in general butterflies are to be obtained only casually. Moths are still more rare: I had provided myself with bull's-eye lanterns, and repeatedly took them out after nightfall, carefully searching the banks and hedges by the sides of roads, the margins of woods, &c., but never, in this way, took a single specimen. At some seasons, however, as December, and more particularly June, on rainy nights, hundreds of little *Noctuadæ, Pyralidæ, Geometradæ, Tineadæ,* &c. fly in at the open windows, and speckle the ceiling, or flutter around the glass-shades with which the candles are protected from the draughts. A good many small beetles, and other things, also fly in on such occasions, and several interesting species I have taken in this way which I never saw at any other time. But in general beetles and the other orders are extremely scarce, and especially Diptera; I have often been astonished at the paucity of these, as compared with their abundance in Canada, the Southern United States, and other localities (in which I have collected) during the hot weather. One may often walk a mile,—I do not mean in the depth of the forest, but in situations comparatively open, beneath an unclouded sun,—and not see more than a dozen *specimens* of all orders. Nor is the beating of bushes productive of insects and their larvæ, as I have found it in North America. In Canada I have shaken off perhaps twenty species of lepidopterous larvæ in the course of an hour or two on an autumnal morning; but I think I have seen scarcely more than half that number of caterpillars in Jamaica during a year and a half's collecting.

To this scarcity of insects however there are two or three local and seasonal exceptions. And this leads me to speak of the principal localities where I have collected my specimens, and to give a brief description of them, which yet will be but superficial, owing to my ignorance of botany and geology.

Bluefields.—I begin with this place, because it was the centre of my operations, and my stated residence during my whole sojourn in the island. Bluefields was once a sugar-estate, situated on a gentle slope, about a quarter of a mile from the

sea-shore. The greater part is now what is called *ruinate,* being covered with a dense and tangled mass of second growth, chiefly logwood, interspersed with calabashes (*Crescentia*) and many fruit-trees, such as the Avocada pear (*Persea*), orange-trees, mangoes, cocoa-nuts, *Blighia sapida,* guavas, papaws, and the different kinds of *Anona.* About a dozen acres are kept open, in pasture, in which there grow many flowering weeds, as *Argemone, Stachytarpheta,* small *Passifloræ, Asclepias,* &c. The fences consist of "dry walls," that is, low walls built up of loose stones without cement. Over these sprawl various kinds of *Cereus, Aristolochia, Aroideæ,* and beautiful *Convolvuli, Ipomææ* and *Echites*; while at their bases spring up numberless bushes of *Lantana,* of several species, always covered with their cheerful blossom, *Cleome,* and many papilionaceous and other flowering plants. The out-buildings of a sugar-estate, as the mill, the boiling-house, &c., still stand, but as mere skeletons; the bare walls, the beams and rafters yet remaining, but the planking of the floors and the shingles of the roofs almost quite gone. These buildings present a curious appearance; for with the singular rapidity of tropical vegetation, the whole interior is occupied with young trees, already overtopping the roof, and slender lianes hang down like cords from one to another, or are thrown in loops over the beams; while elegant ferns of many kinds spring from every crevice of the walls both within and without, and, curving outwards, depend in the most graceful forms. Various insects have established themselves in these ruined outhouses: the earthen floor of one is pierced with the burrows of a red Sphex, numbers of which are coming and going, and wheeling hither and thither close to the ground all day long; and in the dry dust of another are hundreds of the conical pit-falls of a Myrmeleon larva, the manners of which I found to agree exactly with those described by Reaumur. The soil of Bluefields is a friable whitish marl; its elevation may be from 50 to 100 feet above the sea.

Bluefields Mountain.—Immediately behind the spot I have been describing rises the loftiest elevation of the western portion of Jamaica. The Peak, which I may have occasion to mention once or twice, is estimated to be 2560 feet above the sea, but this, as well as the summit of the ridge generally, is covered with a dense and tangled forest, except that here and there in isolated spots the negroes have chopped down and "burned over" an acre or two, and planted cocoas (*Colocasia*) and plantains. As they do not reside here, however, but in the lowlands, visiting their mountain-gardens one day in a week, for cultivation or for collecting the produce, the solitude is scarcely broken, and the primæval wildness of nature is scarcely affected by these trivial intrusions. That giant of the lowlands, the

cotton-tree (*Eriodendron*), reaches not to these elevated regions, but its place is supplied by scarcely less bulky fig-trees, whose hoary trunks and broad horizontal limbs are a perfect nursery of *Orchidaceæ* and *Bromeliaceæ*; and magnificent Santa Marias (*Calophyllum*), broad-leafs (*Terminalia* ?), and parrot-berries (*Sloanea*) tower up to an enormous pre-eminence above their fellows. Dense thickets of joint-wood (*Piper geniculatum* ?) grow in large patches to the exclusion of every thing else: in other places the trees are tall, slender, and somewhat open in growth; but the edge of the woods is formidable with cutting sedges and spinous *Solanaceæ*, relieved by beautiful tufts of *Cannæ*. The mountain cabbage and the long-thatch are the prevalent forms of *Palmæ*; tree-ferns are abundant, and caulescent species of great beauty climb to the summits of tall trees; while in the damp and dark hollows, and by the sides of the winding paths which lead to the negroes' grounds, terrestrial ferns of many species grow in luxuriant profusion. Such a scene, beautiful as it is, is not favourable to the development of insect existence; a few species occur there which are not elsewhere met with; but it is at a rather lower range, at the brow of the mountain, that I have found more success in entomologizing. A property of considerable extent is here partially reclaimed, and devoted to the growth of the pimento and coffee; and though its back is bounded by the dark and tangled forest-peaks I have alluded to, its area displays a very different aspect. Five hundred feet of elevation produce some difference in vegetation, and probably the openness of the cleared ground still more. The bamboo, planted along the sides of the shelving road, throws its gigantic plumes overhead; the mahoe (*Hibiscus*) displays its large and showy flowers; the scarlet blossoms of *Malaviscus arboreus* and the crimsoned ones of some species of *Melastomaceæ*, beautify the edge of the forest, and large beds of *Urena lobata* border the road. In such parts as have been cultivated for a few years, and then (according to the custom of West Indian agriculture) allowed to run to waste, bushes of numberless kinds have sprung up, many of which are in blossom at all seasons. Though the flowers of most of these are individually small and inconspicuous, yet from their profusion they present an attraction to Hymenopterous and Lepidopterous insects; and such a wilderness of vegetation is usually more or less productive to the entomologist. In this particular locality I have usually found butterflies pretty numerous, principally *Nymphalidæ* and *Hesperiadæ*, and those of sorts rarely found in the lowlands; but from the tangled character of the "bush," and from the height of the blossomed summits about which they hover, they are less readily obtained than observed. It is to this scene that I shall allude when I

have occasion to mention Bluefields Mountain, distinguishing the loftier and more wooded region as Bluefields Peak.

Sabito.—In going from Bluefields to Savanna le mar, the road for some miles borders the sea-shore, which at first is a sandy beach, but soon rises to a shelving, rubbly sort of cliff, at the top of which the highway passes. The first portion, extending to about a mile from Bluefields, is called Sabito Bottom; the soil here is a heavy sand, mixed with shingle, doubtless washed up by the surf in heavy gales; large masses of the Jamaica lily (*Pancratium*) spring up on each side of the path; a narrow belt of single trees, chiefly of the sea-side grape (*Coccoloba*) on the left hand, overhang both the road and the sea-beach, and on the right a dark and fetid morass is hidden by great bushes of the black-withe. This would seem an unpromising place for a collector, and yet it forms one of the signal exceptions I have mentioned to the general paucity of insects. Many magnificent butterflies frequent this bottom, as *Aganisthos Orion, Charaxes Cadmus, Charaxes Astyanax, Papilio Pelaus, P. Cresphontes, P. Polydamas, P. Marcellinus* and other *Papilionidæ,* besides more common Lepidoptera. And when we get up the hill, where the trees are manchioneel, cedar (*Cedrela*), mahogany, bully-tree (*Achras*), log-wood, &c., with the fragrant wild coffee (*Tetramerium odoratissimum*), the papaw, the trumpet-tree (*Cecropia*), the beautiful Spanish jasmines (*Plumeria alba et rubra*), festooned with the noble tubular blossom of *Portlandia,*—we find insects very numerous. Many species of *Pieris, Callidryas, Terias*; of *Nymphalidæ, Heliconia Charitonia*; of *Lycænadæ,* of *Hesperiadæ,* and not a few of other orders, are at most seasons abundant here. A large portion of my insect-spoils was collected in this locality.

Belmont.—Pursuing the same sea-side road, but in an opposite direction from Bluefields, we come to the estate of Belmont. It is very sandy, close to the sea, and on the same level with Sabito Bottom; yet it possesses some peculiarities both in botany and entomology. Prickly Acacias of several species border the road, intermingled profusely with the formidable pinguin (*Bromelia Pinguin*). The fences are logwood hedges, over which trail many beautiful creepers, as different kinds of *Ipomæa,* and the lovely *Clitoria Plumieri*; and passion-flowers throw their feeble stems and entwine their tendrils among the shrubs and herbaceous plants that fringe the road-sides. Some small *Melitææ, Cystineura Mardania,* and *Charaxes Astyanax*; some pretty low-flying *Glaucopidæ* and *Pyralidæ,* haunt these lanes, and a few rare Coleoptera have been taken from the shrubs.

Content.—About fifteen miles to the eastward of Bluefields, on the road which winds up from Black River towards Hamp-

stead, and the summit of the Luana mountains, stands a little cottage called by this name, singularly situated on a mass of bare rock on the steep mountain-side. Above, below and around is the primæval forest, scarcely interrupted by the small and widely-scattered clearings that here and there occur. From so singular a position—the tops of the trees immediately beneath the little space that surrounds the dwelling scarcely reaching to the level of its base—the eye commands a magnificent prospect, embracing the sinuous coast, from Pedro Bluff on the east as far as Mount Edgecumbe on the west, ranging over the sombre intervening forest with the cultivated openings, and resting on the broad savannas and flooded meadows that surround Black River; this town with its bay and shipping in the distance, and the course of the river itself visible at intervals, winding like a silver thread through the dark morass.

The high-road, passing just behind and above the cottage, climbs the mountain in the zigzag direction so frequently adopted in Jamaica, to diminish the steepness of the ascent; and it is a mile or two of this road that forms the most remarkable exception to the general scarcity of insects that I have noticed. During the month of June the shrubs and trees that border the road (which is cut through the forest) are alive with insects of all orders, but particularly Coleoptera; many species of *Longicornes, Lampyridæ, Buprestidæ, Cassididæ, Chrysomelidæ,* &c., occur by hundreds on the twigs and leaves; and the air is alive with butterflies, Hymenoptera and Diptera. I cannot at all tell why this abundance exists; it is very local; beyond a certain point, the road, the forest, seem to be unchanged, but the insects have ceased: it is very temporary also; it suddenly commences about the end of May, and by the middle of July scarcely a dozen beetles are seen where there were thousands. I might have supposed it a casual thing, if I had had but one season's experience; but in 1846 it was the same as in 1845, the same abundance at precisely the same season, and with the same local limits. It is worthy of record, that at the same time and place the leaves of the trees were studded with shelled Mollusca, of the genera *Helix, Helicina, Cyclostoma,* &c., as I never saw them elsewhere.

It is not improbable that some peculiarities in the geological or the botanical character of this region would account for what I have mentioned; but I regret that of this I have no knowledge. The mahoe (*Hibiscus tiliaceus*), the bastard cedar (*Guazuma ulmifolia*), the mammee sapota (*Lucuma mammosa*), the locust (*Hymenæa Coubaril*) and the trumpet-tree (*Cecropia Peltata*), are some of the forest-trees, with others called burn-wood and down-tree, of which I know not the systematic appellation. But there is one tree which grows numerously in that locality, which I

suppose to have some influence on the Lepidoptera and Hymenoptera; it is provincially called the potatoe-wood; it is at that time covered with blossoms, which, though they grow in thick racemes, offer nothing pleasing to the sight or the scent. But these form the centres of attraction to the insects I have named; *Pierides* and *Theclæ* in particular flutter around the summits in considerable numbers, and swarms of small beetles and flies. The *Bauhinia* displays its elegant blossoms, and in one corner a large patch of *Cassia* attracts *Papiliones* and *Coliades*; but in general there is an almost total lack of the flowering herbaceous vegetation that fringes the roads in most other places. It is remarkable also that the trees in these woods are nearly, if not quite, destitute of epiphyte *Orchidaceæ*, which are so abundant on Bluefields Mountain at a similar elevation, that hardly a tree is without one or more specimens. But in other respects the character of the vegetation in the two regions differs greatly.

This district I habitually visited every alternate week, very frequently spending eight or ten days at a time with my worthy friends at Content. Probably two-thirds at least of my collection of insects were the result of my labours here. The elevation of the region may be assumed (I speak only from my own estimate) as ranging from 1500 to 2000 feet above the sea.

Before I leave this subject, I would add, that during the period of insect-abundance on the Hampstead road, a large number of species were taken by flying in at the open windows of Content cottage by night. Many valuable specimens occurred in this way, not only of the crepuscular and nocturnal Lepidoptera, but of other orders in considerable variety. *Curculionidæ, Longicornes* and *Lampyridæ* were very numerous. I am inclined to think that a far greater number of insects are active by night than by day.

At length then I proceed to the list of species, deferring the notice of a few other less important localities until they arise.

[To be continued.]

XIII.—*A few general Remarks on the Fossil Conchology of the Great Oolite of Minchinhampton in comparison with that of the same Formation in other localities.* By John Lycett, Esq.*

The following observations have been suggested to me by a remark of Dr. Buckland in his Bridgwater Treatise, and which has since been occasionally quoted and repeated by others;—in effect, that during the vast period when the secondary formations

* Read before the Cotswold Naturalists' Club at Purton, August 3, 1847.

were in process of deposition, a molluscous class (the carnivorous Trachelipods), which in our present seas perform the office of keeping down within due limits the other molluscous races, did not then exist, or that they were extremely few, and that it was only on the extirpation of those extensive genera of Cephalopods, the Ammonites and Belemnites, at the commencement of the tertiary epoch, that the carnivorous Trachelipods made their appearance. Living in a district distinguished by a great profusion of molluscous remains, a large proportion of which are absolutely unknown to science, a favourable opportunity for testing the correctness of the foregoing theory was presented to me, more especially as these remains occur in an unusually good state of preservation, extending in some instances even to the original colours of the univalves, the hinges of the bivalves, and the external ligament of the hinge in the latter shells. Before however stating the results of this inquiry, a very brief sketch of the physical and geological characters of the district may not be unacceptable to the members.

A circle having a radius of only four miles, with the town of Minchinhampton in the centre, will comprise the whole district to which these fossils refer. The Bath Oolite, or Compound Great Oolite as it is now termed by geologists, is the uppermost formation; its continuity is however broken by two great valleys of denudation, the vales of Brimscomb and Woodchester, which, with their numerous lateral ramifications, have cut through the whole series of rocks from the upper part of the Great Oolite to the middle of the lias inclusive, having a mean depth of 500 feet, thereby producing a combination of circumstances eminently favourable for exposing the useful beds of stone and conveying it by water-carriage.

The divisions of the Compound Great Oolite are, Great Oolite and Fuller's Earth, the former having a thickness of 130 and the latter of 70 feet. At some few localities the base of the Great Oolite has one or two beds of true Stonesfield slate associated with brown marls. In this respect however, as in the mineral character of the formation generally, the greatest variety and uncertainty exist; opposite sides of the same quarry will often exhibit such a change; thus an oolitic and shelly limestone will pass into a barren sandstone. Keeping this fact in view, a considerable latitude must be allowed in the following arrangement, which is given only as a general and approximate view of the whole series of beds. The Great Oolite proper may be conveniently subdivided into three series of beds, an upper and lower fossiliferous, often serviceable for building purposes, and a middle, more barren and unserviceable. Beginning with the uppermost, or those which immediately underlie the Bradford

clay, we find an alternating series of limestones and clays or marls, extremely variable both in thickness and extent. Certain of these bands, and more especially one of a compact cream-coloured limestone, are eminently shelly, but will seldom allow of the shells being separated entire. These gradually pass downwards into the middle subdivision, where the rock is more barren of organic remains, and sandy.

The lower subdivision assumes a very different aspect: we here find 35 or 40 feet of shelly beds, separating into large masses, and well suited for the mason. From the third or lower subdivision it is that nearly the whole of our fossils are derived, the stone usually admitting their being cleaved with a knife.

The uppermost portion of this series, the planking*, which is from 8 to 10 feet thick, contains the most numerous suite of zoophagous Trachelipods, several of which are not found beneath it. To this succeeds a few feet of incoherent sandy rock, the upper part of which is nearly destitute of shells, or only occupied by a few species of small bivalves. The shells gradually increase in number downwards, and repose on several beds of hard shelly rock, locally called Weatherstone. Here more especially abound the valves of small oysters, which at length constitute no inconsiderable portion of the mass, and whose peculiar structure imparts such great hardness to the deposit, that the lower few inches strike fire with the tools of the workmen.

These shelly beds or weatherstones have a high character for durability; they have a coarse aspect; when once dried by exposure to the sun they do not readily absorb water, and consequently resist the action of frost; a careful selection is however necessary to ensure this desideratum. The south transept of Minchinhampton church, five centuries old, is built of this stone, and notwithstanding its very exposed situation, displays all the sharpness and distinctness in its angles and carving which we should expect in a modern edifice.

The Fuller's earth which underlies these deposits is but partially and imperfectly exposed within the district; it consists of a series of brown and blue marls and clays traversed by three or four bands of a hard argillaceous rock locally called clay rag. Some portions of the clays, and more especially the rag-stones, are made up of the valves of small oysters, chiefly *Ostrea acuminata*; the organic remains however are far from numerous when counted by number of species; they are nearly all bivalves, and I have not observed any which are not likewise found in the weatherstones above. The Fuller's earth constitutes the most fertile soil in this part of the county; when properly drained it

* A local term indicating a thin-bedded stone.

is well-adapted for pasturage and orchards, which together with a good supply of water derived from the superincumbent oolite, has made it in populous districts the chosen seat of man's habitation; accordingly its course may be traced by a belt or terrace, more or less wide, of houses and gardens encircling the hill-sides. Landslips from such a yielding deposit, as might be expected, are frequent, and thereby render the barren slope of the inferior oolite fertile: a coating of its marls sometimes extends even down to the lias. The numerical proportion of species obtained by me from the Minchinhampton Great Oolite are in number as follows:—

Bivalves 164, Univalves 141, Radiaria 13, Cephalopoda 9. Of the latter 6 are Ammonites; these are so scarce, that 50 specimens probably exceed the entire number. Of *Nautili* there are two species, one of which has furnished only three specimens, and the other is far from numerous. The Belemnites have only one species, small and likewise scarce.

Of the 141 Univalves 45 pertain to carnivorous genera, exclusive of 8 species of *Phasianella*, the living shells of which are now known to be both carnivorous and phytophagous. These genera are, *Nerinæa* 13 species, *Cerithium* 5, *Murex* 6, *Buccinum* 2; a new group of large shells belonging to the *Muricidæ*, to which as yet no generic appellation has been given, 4 species; *Pleurotoma* 1; *Hippocrenes*, a group of winged shells differing from the *Rostellariæ* of the recent period, 10 species; *Fusus*, or a group at least belonging to the *Fusinæ*, 4 species.

This extreme paucity of the Cephalopoda, taken in connexion with the occurrence of numerous genera and species of carnivorous univalves, is a remarkable circumstance. We know that previously throughout the lias and inferior oolite the Cephalopods reigned supreme amongst the molluscous tribes. Subsequently also the Oxford clay and Portland oolite contained them in nearly equal profusion. With these facts before us, the inquiry naturally follows,—Were there any peculiar circumstances connected with the mineral character of the deposit at the locality in question, and what was the probable depth of the sea over the shelly beds; since we find here zoophagous tribes differing from those of warm seas at the present time not very materially either in number or in their generic affinities? First, with regard to the nature of the deposit, or at least the more shelly portions of it:—In the planking and Weatherstone beds we find heaps of broken shells piled diagonally, the bivalves rarely having both valves in apposition; with these are fragments of wood, crabs' claws, joints of Apiocrinite and Pentacrinite, ossicula of Ophiura, palates and teeth of fishes, small bouldered fragments of Madrepores, and nodules of rock apparently

foreign to the deposit: these conditions vary and change every few yards, as likewise does the mineral character of the beds;—the results, in fact, of littoral action; of a shallow sea where the shells were subjected to strong currents producing hasty deposits and frequent trituration. The oolitic structure is rather scanty and very uncertain. As a complete contrast to these conditions, the Great Oolite in the vicinity of Bath may be cited. The rock is there thick-bedded; the oolitic structure prevails; the shells are few, and those chiefly *Terebratulæ*; the denizens, it may be presumed, of a deep and tranquil sea, in which corals and sponges multiplied and attained large dimensions. In Mr. Lonsdale's list of 31 species of Mollusca from the Bradford clay, Bath oolite and Fuller's earth of that neighbourhood, no less than 8 are *Terebratulæ*, and a *Crania* has since been added; a larger number of Brachiopods than will be found in the 327 Minchinhampton species which I have tabulated.

The list given by Mr. Buckman, in his 'Geology of Cheltenham,' from the Bradford clay and Stonesfield slate of the Cotteswolds in the north-eastern part of this county, comprises 5 Radiaria, 2 Terebratulæ, 44 Bivalves, 6 Cephalopoda, and 19 Univalves. Stonesfield has yielded a rich store of remains of reptiles, fishes, crustacea and land plants, but the conchological list is but meagre, and we are nearly destitute of information with regard to the shells of the Great Oolite in its long course through the counties of Northampton and Lincoln. Yorkshire, on the other hand, has found able illustrators in Phillips, Williamson and Bean, the latter gentleman having given, in the 'Magazine of Natural History for 1839,' a list of fossils from the stratum called Cornbrash in that county, consisting of 4 Radiaria, 3 Annulata, 91 Bivalves, 16 Univalves, and 3 Cephalopoda. Unfortunately, however, the rocks beneath the Oxford clay in that county form a great carboniferous series of deposits accumulated in an estuary, and will not allow of its subdivisions being identified with those of the middle and west of England. From this cause the shells have little more than a local value, since we cannot be sure that any particular stratum is contemporaneous with another in a different locality. On looking at these lists, together with those relating to the oolitic rocks of France, Germany and Switzerland, we are struck with the great paucity of univalves as compared with the small district of Minchinhampton.

A careful scrutiny however of various foreign works which bear upon the subject,—of the works of Goldfuss, Roemer, Dunker, Deslongchamps, d'Archiac, &c.—has convinced me, that if any peculiarity exists with regard to the Minchinhampton fossils it is at least of a very limited nature, inasmuch as nearly

one-half the entire number of bivalves can be identified in those works, a considerable number being from the coral rag of Hohenggelsen, which seems to be the equivalent of our Great Oolite. Among the univalves, the general resemblance to the Minchinhampton shells is so great, that at first we feel prepared to identify the greater number of them; a closer scrutiny undeceives us, and ultimately we are surprised at the very few which we can call our own. It may be suspected indeed, that the meagre lists of univalves hitherto published relating to the formation in question are the result, not so much of an actual deficiency of those shells, as of the difficulty of separating them from the stone in a condition sufficiently well-preserved to admit of specific characters being recognized. The oolite of our district itself furnishes an instance in illustration; almost the entire suite of univalves are procured from quarries to the north and west of the town, and even within those limits are certain localities from which the univalves can hardly be separated; but in the upper and middle subdivisions, to the east of the town, we can obtain but few, and those only which approach the globular figure, as *Natica* and *Bulla*, usually in the form of casts; with slender spiral shells the attempt is hopeless. These circumstances however are altogether independent of the great fact forced upon our attention,—viz. the scarcity and almost entire disappearance of the Cephalopoda from the sea of this portion of the Cotteswolds during a period in which deposits 200 feet in thickness were formed, and the simultaneous appearance of a large number of new and more simple forms to supply their place.

With our present very scanty knowledge of the circumstances which conduce to change of species on the floor of the sea, reasoning would be little better than conjecture; I have therefore rather preferred to state facts as they are presented to my notice, reflecting that every such contribution, however insignificant, is something added to the general store of knowledge, and consequently an aid to our conceptions of the operation of that infinite and all-pervading wisdom which is exemplified equally in the lowest as in the highest beings of creation.

Hence, though it is well known (as above-quoted from Dr. Buckland), that throughout the vast deposits of the secondary rocks those important tribes of Cephalopods, the Ammonites and Belemnites, reigned supreme amongst the molluscous races, and that they became extinct prior to the commencement of the tertiary æra, their paucity in the Great Oolite of Minchinhampton would lead us to infer that some peculiar conditions of sea-bottom existed at that locality which were unfavourable to their increase. But so far from the carnivorous Trachelipods "not having existed prior to the commencement of the tertiary æra,"

we here find them in the middle of the secondary deposits in great force and variety, forming in fact a considerable proportion of the whole number of univalves, and consequently existing long before the extinction of the Ammonites and Belemnites.

It is highly probable that Dr. Buckland would not now adhere to the above theory, stated some ten or eleven years ago; but having the authority of his name and occurring in a standard work, it still passes current with the reading public, and has frequently been quoted by subsequent writers.

On a future occasion I anticipate the pleasure of presenting to the Club some remarks more in detail on the new or less-known molluscous forms which occur in this formation. The Inferior Oolite within the narrow limits of my observation has likewise yielded a considerable store of novel materials for investigation: these would require a separate communication.

XIV.—*Descriptions of new or imperfectly described Lepidopterous Insects.* By Edward Doubleday, Esq., F.L.S., Assistant in the Zoological Department of the British Museum, &c.

[Continued from vol. xix. p. 389.]

Fam. PIERIDÆ.

Genus Euterpe.

Eut. Manco. Eut. alis omnibus supra nigro-fuscis, atomis cinereis adspersis, anticis fasciis duabus transversis macularibus, maculisque marginalibus cinereis; posticis macularum sagittiformium serie, maculisque marginalibus cinereis. Exp. alar. 2 unc. vel 50 mill.
Hab. Bolivia.

Above: anterior wings fuscous, sprinkled with cinereous, the cell with a cinereous spot at the extremity; followed by two transverse macular bands of the same colour running nearly parallel to the outer margin, the inner one becoming wider and less defined towards the inner margin, the outer margin marked with a series of cinereous spots between the nervules. Posterior wings fuscous at the base, then thickly sprinkled with cinereous scales, so as to form a broad band across the middle of the wing in continuation of the first band of the anterior wings: beyond the cell fuscous, with a series of sagittate spots composed of cinereous and fuscous scales, about equally mixed, and on the margin itself a series of cinereous spots. Below: the anterior wings are grayish white, towards the apex slightly silvery; below the subcostal and also the median nervure is a fuscous vitta, arising from the base, and at the end of the cell a fuscous spot; about half-way between the cell and the outer margin is a transverse fuscous band, nearly straight internally, very angular ex-

ternally, marked near the costæ with a black spot, on each side of which is a yellow dot, the outer one followed by two larger ones of the same colour placed on each side of the discoidal nervule; the margin with a series of seven triangular spots bordered with black, the four nearest the apex yellow, the others cinereous. Nervures, nervules and cilia fuscous.

Posterior wings silvery white, the base with a black patch, bounded anteriorly by the costal nervules, marked with eight yellow spots, and a single crimson one on the inner margin; cell with a slender black line along the median fold, throwing off a slender branch internally near the end of the cell, this line bounding externally a bright yellow vitta. Beyond the cell is a series of yellow cuneiform spots bounded internally with black, and there is a similar series on the outer margin; the space between the first median nervule and the submedian nervure is marked with a yellow vitta. Nervures, nervules and cilia black.

Head, thorax, abdomen and legs fuscous, more or less clothed with gray hairs; the abdomen paler below. Antennæ black.

This species and the last-described are very nearly allied, and may possibly prove to be varieties of one species. The whole of this group, of which *Euterpe Semiramis* may be regarded as the type, are very difficult to determine.

Genus Leptalis.

L. Eumara. Lept. alis anticis supra nigris fascia media, alteraque pone medium macularibus flavis; vitta baseos pallide testacea, posticis, supra, testaceis, margine, nervulis, lineisque inter nervulos nigris. Exp. alar. 2 unc. 4 lin. vel 60 millim.

Hab. America Meridionali.

Above: anterior wings fuscous black, with a testaceous vitta at the base upon the median nervure, extending along a space about equal in length to one-half the inner margin of the wing; a macular band composed of a large spot, slightly divided by the nervules, and of a much smaller one, extends from the middle of the costa nearly to the anal angle, close to which on the inner margin is a small yellow streak: near the apex is a transverse band of four yellow spots. Posterior wings reddish, with the outer margin broadly fuscous; the median nervure and nervules, a series of dashes between the nervules, also fuscous.

Below: nearly as above, but all the colours paler; the dark border to the posterior wings less distinct.

Head black, antennæ black; palpi yellow internally, black externally.

Thorax black above.

Abdomen fuscous above, gray below.

In the collection of Conrad Loddiges, Esq.

L. Theucharila. Lept. alis anticis supra nigris, vitta seu plaga triangulari basali fulva, maculisque tribus pone medium flavis, posticis fulvis, *maris*, fimbria fasciaque submarginali nigris, costa late selenitica; *feminæ* margine anteriori externoque, vitta subcostali fasciaque submarginali nigris, puncto apicis fulvo, luteove. Exp. alar. 2 unc. vel 50 millim.
Hab. Venezuela.

Above: anterior wings black, the base with a fulvous vitta, occupying in the male nearly the whole of the cell, and in the female extending beyond it across the median nervure; on the costa is a yellow spot divided by the first and sometimes also by the second subcostal nervule, below which, upon the third median nervule, is a small oval yellow spot in the male, a larger one in the female, and towards the apex is a short yellow fascia divided by the last subcostal and the first discoidal nervules. Posterior wings *of the male* fulvous, with the outer margin black, a band of the same colour extending from the hinder part of the inner margin to the outer margin near the termination of the third submedian nervule; the costa widely of a satiny or selenitic white. Posterior wings *of the female* fulvous, with the fuscous border and the submarginal band rather broader than in the male; the costa black, divided by a fulvous vitta terminating in a spot of the same colour.

Below: the anterior wings have the costa brown from the base to the middle; the apex as above, but paler, and with a series of eight white dots near the margin; the remainder of the wing whitish, with a selenitic lustre along the middle of the wing, a chalky appearance towards the inner margin. Posterior wings of the male pale dull luteous, yellower towards the costa; the outer margin, the costa beyond the middle, two bands, one along the middle of the wing, the other near the outer margin, fuscous; a space above the first band nut-brown; near the apex are two white dots, and in the fuscous margin three or four faint dashes of white between the nervules. Posterior wings of the female more fulvous than those of the male, the black margin and band broader, the marginal white spots more distinct.

Head black; antennæ black, dotted with white; orbits and a patch on the vertex white.

Thorax and abdomen fuscous ash below. Legs black, lined with white.

In the collection of the British Museum, W. C. Hewitson, Esq., &c.

In size and form this beautiful species resembles *Leptalis Methymna*, but in colouring approaches nearer to *Lept. Amphione* and its allies.

L. Theugenis. Lept. alis omnibus supra læte flavis, anticis macula media costali apiceque nigris, posticis margine externo nigro. ♂. Exp. alar. 2 unc. vel 50 millim.
Hab. Bolivia.

Anterior wings elongate, rounded at the apex, the first subcostal nervule anastomosing with the costal nervure. Above: bright yellow, the apex from the termination of the first subcostal nervule to that of the third median nervule black; this black patch united to a spot of the same colour occupying the outer margin as far as the termination of the first median nervule. Posterior wings yellow, the outer margin fuscous from the apex to the first median nervule; the fuscous margin broadest at the apex.

Below: anterior wings yellow on the costa and at the apex, the dark markings of the upper surface slightly indicated; the rest of the wing whitish, the inner margin with a large spot of a chalky appearance. Posterior wings yellow, with two pale brown bands, the first extending along the subcostal nervule to its termination, the second below the cell extending from the submedian nervure to the second subcostal nervule, which it just crosses.

Head, thorax and abdomen brown above, yellow below. Antennæ black. Legs, except the coxæ, black, with a pale yellow line on each side.

In the collection of the British Museum.

This species is closely allied to *Lept. Melite,* from which however it may be known by the want of the black vitta on the inner margin and of the yellow spot in the black of the apex, independent of some less striking differences.

XV.—*Reports on the Progress of Physiological Botany.* No. 2. By Arthur Henfrey, F.L.S. &c.

Anomalous Forms of Dicotyledonous Stems.

Prof. Treviranus* has published an exceedingly interesting essay on the anomalous forms under which the wood presents itself in certain dicotyledons, in which he endeavours to arrive at some general conclusions as to the regulating causes. The essay is a kind of critical examination of all the observations hitherto published on the subject, interspersed with the results of new investigations undertaken by the author with a view to explain or confirm the views of other writers.

Our attention is first directed to those remarkable bodies called

* Botanische Zeitung, May 28, 1847.

Embryo-buds, first described by Dutrochet*, and considered by him to be buds, which instead of becoming elongated are developed on all sides, and, producing no leaves, are nourished by the sap of the bark. Prof. Treviranus remarks that this view is difficult to reconcile with the generally received opinion that the formation of wood depends on the presence of leaves, and new investigations upon living specimens are very desirable; it is obvious however that the production and development of secondary layers of wood occurs here, quite separate and distinct from the central primary ligneous body of the tree. [With regard to these remarks it may be observed, that it is only if we admit the notion that the new layers of wood actually grow down from the leaves, like roots, as is affirmed by Gaudichaud, that there is any difficulty in adopting Dutrochet's views. If the leaves only elaborate the juices for the formation of new wood, the elaborated sap conveyed down in the bark and cambium-layer may go to form new layers around the nucleus it finds in the shape of an embryo-bud, just as readily as to increase the great central woody mass of the tree.—*Rep.*]

The author next notices those stems in which, in addition to the central woody mass, from three to ten smaller ligneous masses occur surrounding the central one and increasing in size in proportion to it. Mirbel † first pointed out this structure in *Calycanthus floridus*, and Gaudichaud ‡ in the *Sapindaceæ*. The course of the formation of the four secondary woody masses in *Calycanthus* is as follows:—In a young stem there are found four vascular bundles in the bark, distinct from the central wood, and from each other except at the nodes, at every one of which cross bundles uniting these together form a ring round the central body; as the stem grows, new layers of woody substance are deposited on the *inner* faces of these bundles (which are of course carried outward with the bark to make room for the increasing thickness of the central mass of wood). These new layers are considerably thicker than the outer, previously formed; they are also progressively wider, and thus form a somewhat crescent-shaped body (when seen in a transverse section); the horns of the crescent advancing outward gradually approach and meet, so as to include a portion of the bark, which then forms what resembles a kind of pith to it. This false pith of each woody mass is thus of course excentrical, the woody layers which surround it being fewer and thinner on the outer side.

In regard to the origin of this structure, Mirbel compared the four bundles to those lying in the angles of the square stem of

* Nouv. Mém. du Mus. d'Hist. Nat. iv.
† Ann. des Sc. Nat. xiv. ‡ Archiv de Bot. ii.

Labiatæ; but the author states that this is incorrect, inasmuch as these latter are the commencement of the central ligneous system, being in fact afterwards united together into a ring by new bundles which are produced between them.

The author says he formerly imagined these secondary wood masses to have the import of branches, but he has now given up this opinion, having found the structure to be normal in several other instances. In trees with opposite leaves, like the ash and horse-chestnut, the woody mass presents the following peculiarities in the youngest internode: the vascular bundles from each petiole, arranged in a semicircle, unite with those of its fellow to form a circular or rather somewhat quadrangular mass; at the next node below, this opens on opposite sides to receive the bundles of the petioles there situated, and again closes. In *Calycanthus* the fibrous substance of the petiole also forms a semicircle, containing the vascular bundles of all the nerves of the leaf except that of the lowest or outermost nerve on each side, which remains isolated. This isolation is persistent after the two semicircular fibrous bodies have united at the node to form a ring, and thus it happens that the bark of the new-formed stem contains four smaller vascular bodies, outside the regular ring of wood and occupying the four obtuse angles. Tracing the course downward in the stem, we find, at every node, that not only the central ring, but the cortical woody bodies receive accessions, and they have grown independently. In *Calycanthus floridus* therefore (and in *C. præcox* also, although it is not so distinctly exhibited here), the four cortical ligneous bodies originate in the leaf, run down in the angles of the gutter-shaped petiole, distinct from the central mass, and enter the bark at the nodes, where each of them unites with one similar coming down from the leaf above and another coming from the leaf opposite. This observation has already been made, substantially at least, by Gaudichaud, but was doubted, without statement of the reason, by Lindley. Any one may readily satisfy himself of its correctness who will examine this common shrub. [I found the above description of the structure perfectly correct as regards *C. floridus*; I have not examined *C. præcox*.—*Rep.**]

The woody stems of certain climbing *Sapindaceæ* are still more remarkable on account of the number and size of the lateral woody masses; sometimes as many as ten of these occur, inclosed in a common bark, and these rapidly increase in size to

* The arrangement of the woody bundles of the *Cucurbitaceæ* which have pentagonal stems, described by Dr. Stocks in the 'Ann. of Nat. Hist.' for Aug. 1846, bears some relation to this point. It would be interesting to ascertain whether any of them remain distinct, or if they become blended as in the *Labiatæ*.—*Rep.*

such an extent, that they often, collectively, exceed in volume the central ligneous mass of the stem. No other plants but the *Sapindaceæ* are known with certainty to possess this structure, and not even all the genera of this family, nor all the species of particular genera. Gaudichaud does not name the species and only doubtfully the genus in which he found it; A. de Jussieu* names only *Serjania cuspidata.* The author has detected it in *Paullinia pinnata, Serjania triternata,* W., and *Serjania Selloviana,* Kl., but not in *Serjania rubifolia,* K., and *Paullinia obliqua,* K.; not in *Cardiospermum, Nephelium, Kœlreutera, Sapindus saponaria* and *capensis.* He had at his disposal a living stem of *Paullinia pinnata,* bearing leaves, the length from ten to twelve feet, and the thickest portion a German inch in diameter. This stem presented three convex sides and as many obtuse angles in each of which lay a woody mass unconnected with the central mass and separated from it by cortical substance; they were of similar form and almost identical structure. In *Serjania triternata* the stem in the young shoots is triangular with a woody mass in each angle, but in the older twigs the angles and their lateral woody masses are seven in number, and the same structure occurs in *S. Selloviana,* Kl., so that it may be concluded with tolerable certainty that the woody bodies which Gaudichaud† indicated generally as belonging to *Sapindaceæ* were either species of *Paullinia* or *Serjania.* The same may be said of a form of wood from an unknown source described and figured by the author in his 'Physiology of Plants'‡. The number of lateral masses may as above shown increase, but it may also decrease by some of them losing their independence. In one of Gaudichaud's§ plates the upper end of one specimen exhibits nine, the lower only five, another seven above and five below; so that some of them have either become united together or to the central body. Jussieu says: the four woody masses of *Serjania cuspidata,* at the first formation of a shoot, are united into a single mass; but they soon separate and become isolated. The author also, in the twigs of *Paullinia pinnata,* where they run out as side shoots from the triangular main stem, perceived that the form was originally cylindrical, and thus only a central woody mass existed, but that in its course one or more lateral bodies disengaged themselves. The manner in which this took place is thus explained: the circle formed by the aggregated bundles presents three obtuse angles, and the bundles which form these angles diverge outward and leave the combination. They then become

* Monogr. Malpigh.—Archiv du Mus. iii. 110, 117.

† Rech. sur l'Organogr. &c. des Veg. t. 13. fig. 1–4. t. 18. figs. 14, 16, 18, 19, 21.

‡ Phys. d. Gew. ii. 174. t. 1. fig. 6.

§ *Loc. cit.* t. 18. figs. 16, 19.

placed so as to converge more toward each other, since they take away a portion of pith with them, and the centripetal arrangement is finally perfected. In a directly opposite manner occurs their reunion with the central mass by the loss of the concentric arrangement of their woody bundles, and their reception into a cavity which is produced at a corresponding point in the central mass.

From the nature of the composition, therefore, the lateral bodies have a pith, like the central, also medullary rays and fibrous tubes, but the author has not observed annual rings in either. The existence of this pith in the lateral bodies has been denied*, but on insufficient grounds; the round or oval central cellular mass into which the medullary rays enter, for example in *Paullinia pinnata*, cannot be called anything but pith. A. de Jussieu also describes a pith in the lateral woody masses of several *Sapindaceæ*, especially *Serjania cuspidata*, which pith was inclosed in a medullary sheath containing spiral vessels, and was of a cylindrical or flattened form. Gaudichaud figures the latter form of pith, which is centrally situated in the central woody mass, but more or less excentrical, toward the external surface, in the lateral bodies.

It is important to observe that the central and lateral bodies are all inclosed in a common bark which contains a common layer of liber; since this proves that the lateral woody masses are not liber-bundles of the bark, as Martius † appears to have assumed. But the author observes that, so far as his limited materials allowed him to see, the circle of liber above-mentioned does not increase in diameter proportionately with the woody masses.

An attempt has also been made by Martius to explain the presence of these anomalous lateral masses by considering them as undeveloped branches running under the bark in the manner that the roots do in some *Lycopodia*, as was pointed out by Ad. Brongniart ‡, who thereby explained some phænomena observed by him in the fossil genus *Sigillaria*. Lindley § has observed a similar condition in a *Barbacenia* from Rio Janeiro. Before these phænomena can be applied to an elucidation of the structure of the *Sapindaceæ*, it is necessary to investigate these lateral woody bodies in their earliest conditions. With this view the author examined *Paullinia pinnata*, taking a yet herbaceous twig about eighteen inches long on which three leaf-scars existed on the three angles, while two leaves were still in a vege-

* Schleiden, Grundz. 2nd ed. ii. 162.

† Ueber die Veg. d. unächt. u. ächt. Parasit. Münch. gel. Anz. 1842, N. 44–49. 390.

‡ Archiv du Mus. i.

§ Introd. to Bot. 3rd ed. 316. figs. 191–3.

tating condition at its apex. Each scar presented on its roundish disc the almost perfect circle of vascular bundles of the fallen leaf; above the scar was a dried bud, and below it a strong, blunt ridge ran downward on the stem. On each side of the cicatrix was a little semicircular scar indicating the articulation of the fallen stipules, and from each of these lateral scars an acute ridge originated which became united with a similar one coming down from the leaf next above. On the examination of the living leaves it was perceived that the vascular bundles of the petiole formed the central woody mass, and those of the wing of the petiole and of the stipules, the lateral bodies. These were quite isolated just below the node; but in another twig which was examined, either two or the whole of them were always united to the central mass, and this was particularly the case in a twig which had a roundish instead of the usual triangular form. So that this anomalous structure of the wood of *Sapindaceæ* has its origin at the earliest stage, and is connected with the formation of leaves rather than of branches, and depends upon a peculiar tendency of the vascular bundles to develope independently of each other, round several centres, which tendency however they occasionally lose and subsequently blend with the central mass.

The structure of the wood of the Malpighiaceous Lianes agrees to a certain extent in appearance with that of the *Sapindaceæ*, and here it is evident that the lateral bodies do not belong to the liber. But according to A. de Jussieu the lateral bodies show no disposition to arrangement of their fibrous tubes and vessels around a pith, as occurs in the *Sapindaceæ*. He has also shown that the wood lying immediately around the central pith is very regularly formed, and has narrower and straighter medullary rays than the layers subsequently produced; while in the *Sapindaceæ* the separation of the lateral from the central masses is evident in the very earliest stages of the formation of the wood.

In the same memoir Jussieu has mentioned several climbing dicotyledons of very different families, where the masses of wood have a tendency to become separated from each other; to these may be added the climbing species of *Begonia*. Those species of *Begonia* with an upright stem have the wood symmetrically formed, but in, for example, *B. hirtella*, the wood on the side of the stem next the wall on which the plant grows is scarcely half so thick as upon the other side which has been exposed to no pressure; on this side the wedges of wood are much expanded and quite unsymmetrical, being separated from each by medullary rays which equal them in breadth.

Lastly may be mentioned some peculiarities in the wood of certain climbing *Bignoniaceæ*, figures of which are given by Lind-

ley*, Gaudichaud † and Schleiden ‡. Here the general mass of the wood is interrupted by plates of a different substance which pass in from the circumference to the centre, which substance, if it be wood, is of a distinct kind from the rest; these plates correspond to each other on the opposite sides of the stem. Gaudichaud says that the *Bignoniaceæ* in Guayaquil have originally four of these plates, next eight, then sixteen, and probably afterwards thirty-two; but he never saw this in the plateaux of Brazil.

Analogous but less regular divisions of the wood occur to a certain extent in old stems of *Bignonia capreolata*, but here only four plates exist in stems even two inches in diameter. In a stem of a *Bignonia* collected in Columbia by Karsten (marked No. 33) there are eight such divisions, of which four are not so broad as the other four, and they correspond to each other exactly on opposite sides of the stem. Jussieu found four in *B. Unguis Cati* and *B. grandiflora*; in a Bignoniaceous plant from Peru eight, with the traces of the commencement of a duplication of them, which would thus have made sixteen.

Their intimate structure exhibits chiefly fibrous tubes, agreeing with those of liber, but in *B. capreolata* the author found vessels. The former are arranged in transverse rows with thin layers of cellular tissue interposed; an organization similar to that of liber. They never reach quite to the pith, the wood immediately surrounding this is therefore undivided, and they are only firmly united to the true wood at those points where they terminate internally. A recently gathered leafy shoot of *B. capreolata* about a line and a half in diameter, exhibited the first trace of these four introversions of the liber. Where each of these originated in the bark there was a fibrous bundle like the others, but much larger. There were four of these chief bundles, and they had their origin in the petiole like the woody bodies of the bark in *Calycanthus* and *Paullinia*. It appears therefore that continual additions are made to the liber on the inside of these bundles as the wood of the stem increases in diameter, and consequently, no formation of true wood occurring at these points, cavities would result, but that the liber bundles grow inward and fill them up.

Comparing these last-mentioned forms of ligneous structure with that of *Calycanthus*, of certain *Malpighiaceæ* and *Sapindaceæ*, the distinction is observed, that in the *Bignoniaceæ* the fibrous substance, separated from the chief mass of the wood, does not develope outside the latter, but in and with it, at the same time

* Introduct. to Botany, fig. 38.

† Recherch. &c. t. 14. fig. 4, t. 18. figs. 4–10.

‡ Grundzüge, &c. 2nd ed. fig. 146–148.

without becoming blended with it. But here however, as in the *Malpighiaceæ*, has been observed a disposition to separation of certain portions of the wood from the central mass *.

We require more investigation to enable us to determine the relations of the structure of *Phytocrene* to that of the *Bignoniaceæ*; especial attention should be paid to the conditions at different periods of the growth. Jussieu opposes the opinion that the plates passing inward from the bark belong to the liber, on account of the different structure of the liber observed in the same stem. But since this difference consists in the fact, that, according to Griffith †, they also contain striped vessels of small size, while in the proper wood these are larger, in shorter joints and of the dotted kind, the author does not think this is sufficient reason to overset the idea that they originate from the liber. In *Nepenthes* the ligneous twining stems, the bark, liber and pith, are full of spiral-fibrous cells ‡, a proof that under certain circumstances these may occur in parts of the stem where they are not usually found.

Glancing retrospectively over the anomalous forms of dicotyledonous stems we have enumerated, this much is evident, notwithstanding the imperfection of the observations arising from the want of materials:—the fibrous and vascular bundles descending from the leaves are in general destined to be collected around a common centre and there to become united together, but yet in their ever-progressive vegetation a certain independence is retained by them, so that certain collections of them may separate from the main body and be developed independently. This development will at the same time proceed according to the law of symmetry, *i. e.* they will arrange themselves around a centre, and, in case the stem belongs to a dicotyledon, be placed in a radiating series behind one another. What external cause must arise, to produce such deviations from the usual mode of growth, cannot yet be determined for want of comparative observations, in the localities where these stems are found. Jussieu conjectures § that one of the chief causes of these peculiarities is the remote position of the leaves, the distance between them being greater in the Lianes than in other plants. But the author says, that, if he is not mistaken, twining shrubs of the same families are met with without the anomalous structure; thus it seems that some special impression must be received, which is given to the formative principle by some external cause, such as pressure in a particular direction, as mostly if not always happens in climbing stems. It is well known that *Bignonia radicans*, also

* Jussieu, Mém. Malpigh. 119.

† Wallich, Pl. Asiat. Rar. 216.

‡ Korthals Verhandelingen, t. 20.

§ Cours de Botanique, t. 81.

a Liane, has, when in a condition where it can freely extend itself, the usual symmetrical wood-structure. But Uttewall * observed a stem of this plant flattened into a band-like form, arising from pressure against the angle of a wall, which form it still retained after it had grown up far beyond it, so that the numerous shoots afterwards developed all partook more or less of this character.

[As somewhat relating to the present subject, may be mentioned a curious fact lately pointed out by Prof. A. E. Rossmässler. He states that the Firs are subject to a peculiarity in the growth of their wood which causes them to split obliquely instead of perpendicularly, and that this occurs, for instance in *Pinus sylvestris*, throughout whole estates, in Bavaria, and it is necessary to raise young plants from foreign healthy seed, since the seeds of these twisted firs inherit the peculiarity of the wood. —*Rep.*]

BIBLIOGRAPHICAL NOTICES.

Rare and Remarkable Animals of Scotland, represented from living Subjects; with practical Observations on their Nature. By Sir John Graham Dalyell, Bart. Volume first, containing fifty-three coloured Plates. London: John Van Voorst, Paternoster Row, 1847. 4to. Pp. 270.

We could wish that this noble volume was in the hands of every one of our readers. It is, always excepting Ellis's 'Essay on Corallines,' the most valuable contribution to Zoophytology ever made by one individual, and contains more that is true and of interest in the economy of zoophytes than any other work hitherto published.

The name of Sir John Graham Dalyell has been familiar to the naturalists of Scotland for nearly half a century. He first introduced himself to their notice by a translation of some of the physiological writings of Spallanzani, a naturalist of congenerous dispositions with himself; and he subsequently became better known by his valuable contributions to our national Encyclopædias, and by his little book on the *Planariæ*, the most interesting by far of any publication on this family of worms. But beyond his native country Sir John was scarcely known until after the meeting of the British Association in Edinburgh in 1834, when the naturalists of England even were taken by surprise on finding one unbruited,—an accomplished scholar and learned antiquary,—who had studied natural history in a more philosophical spirit, and with a less selfish love, than any more blazoned compeer, and who had learned much in the school of nature of what was secret and hidden to others. Henceforth this quietly perse-

* Tijdschr. v. Natuurl. Gesch. en Physiol. iv. 90

vering experimentalist was mentioned by those who write for the public; and foreigners were compelled, almost reluctantly, to acknowledge that the Scotch savans had been for years familiar with facts and phænomena, for the discovery of which, in a less perfect manner, they were seeking the praise and honour of their competitors. The present publication will not only prove Sir John's independent discoveries and priority, but it will place its author in the first rank of those who gain deserved honour by their talent for original observation, and by that devoted love to a subject which carries one unwearied through years of patient experiment, heedless of any future reputation, and regardless of being forestalled by the fear of anticipation which urges on too often to hasty publicity.

In our present notice we shall confine ourselves to the Hydroid Zoophytes. And were we to distinguish these according to diversity in their embryology, the researches of Sir J. G. Dalyell would enable us to divide them into three families, viz. (1.) those which "propagate the young in their own likeness by gemmation or budding from the side;" (2.) those which in the fœtal or larva state resemble the *Medusæ*; and (3.) those which produce an unciliated roundish corpusculum, that, on its escape from the ovarian vesicle, assumes the shape and motions of the *Planariæ*.

The first family is limited to the freshwater Hydræ, and need not now detain us, excepting only to remark that our author appears never to have observed these polypes to propagate by any other means than by gemmation. Their winter eggs, described by others, do not seem ever to have come under his notice.

The species of the second family ascertained to be so by our author are *Tubularia indivisa, T. larynx, T. ramosa* and *Laomedea dichotoma*. The similarity of their larvæ to miniature Medusæ in form, in structure and in habits is so very remarkable, that, even after having witnessed their progressive development and birth from the parent, Sir John can scarcely bring himself to admit their relationship. But there can be no doubt of this, and the metamorphosis is one of the most wonderful in the animal kingdom. We know not that we could make more distinct to our readers the idea of these larvæ than by the comparison of them to Medusæ which has just been made, and must therefore refer to the volume itself for the full details. The interest of the zoologist will not flag in their perusal, and in the examination of the figures; although there is certainly wanting that precise and regular specification of embryotic changes which distinguishes the memoirs of Van Beneden.

The third family embraces *Tubularia ramea, Thoa halecina* and *Beanii, Sertularia polyzonias, abietina, rosacea, pumila, argentea* and *arcta, Antennularia antennina* and *ramosa, Plumularia falcata* and *pinnata*, and *Campanularia verticillata*. All these produce a roundish oviform body, which on, or even previous to, its eduction from the ovarian receptacle assumes the figure of the worms of the genus *Planaria*. Hence it is called a *planule* by our author. It appears to be an immediate evolution from the central pulp, the colour of which it has on its birth; but some species produce planules of at least two

colours, as, for example, the *Plumularia falcata*, which produces some white and some yellow. The number produced varies according to the species, nor does it seem to be uniform even in the same species. After moving about in the open waters for some hours, not by cilia but by inherent mobility, the planule rests and settles on some fixed body, where it contracts itself into a circular spot, whence the young polypidom speedily shoots up in the shape of a primary spine. We quote the author's description of the planules of *Sertularia polyzonias*:

"About fifty planules issued from the vesicles on the 8th of July, the specimens having been procured on the day preceding. These animals were nearly a third of a line in length; the body plump, approaching rotundity, somewhat flattened below, of a smooth uniform aspect, and darker in colour than straw-yellow. In course of their escape they were obviously suspended from various parts of the specimen by an invisible thread; but when reaching any solid surface they advanced with an equal, gliding motion, resembling that of *Planariæ*. The observer could not associate them with any other genus in the 'Systema Naturæ.' No external organs could be detected by the most careful microscopical inspection. They assumed various forms, according to circumstances, and, as afterwards established, these were modified also, according to the period of their existence.

"Many planulæ continued quitting the vesicles from the 8th until the 12th of July. They spread on the bottom and crowded together on the sides of their vessels. Numerous dark green, thick, obtuse spines were rising from spots on the bottom on the 14th of the month. Several were enlarging as buds next day, which had developed as a hydra from some others of them." (p. 146.)

These discoveries in the embryology of zoophytes will necessitate some alterations in their systematical distribution, and will, we are inclined to think, lead ultimately to the recognition of new principles on which to found even their distribution into new classes.

The book is full of particulars relative to the growth, the almost unlimited regerminations, the structure and physiology and the habits of zoophytes, but the interest lies rather in the minutiæ and truth of the details than in general deductions, and cannot be relished unless by a student who will read them seriously and in earnest and in the *spirit* in which they are written, for the *style* is unfortunately sometimes ambiguous and obscure, and too often Johnsonian without the Johnsonian antithesis and elegance. We shall therefore pass on to particularize the species described, making a remark or two as the occasion arises.

1. *Tubularia indivisa.* This is described and illustrated with minute detail, and is evidently a favourite. The experiments made to test its tenacity of life and its regenerative powers remind us of those made by Trembley and Baker on the Hydræ, and they are equally remarkable, but to detail them would be endless, for, as the author tells us, "no definite rules or principles can anticipate the precise course of reproduction," p. 28. Sections of a single stalk will each of them produce a new head, more especially the section

near the base; but the mode of growth of the stalk itself is more remarkable still. The head of the polype falls off and this is followed by an elongation of the fistular stalk, the point from which the elongation started being distinctly marked by a circular stricture; another head is then produced and this again falls away, and again there is an elongation of the stalk upwards; and so on the growth proceeds for several periods in succession. But the successive growths are not regular either in time or in their lengths; the periods and length of the new prolongations being dependent on circumstances not yet understood. There is something in this very curious, and we shall better impress attention to it by the following extract:—"Some remarkable facts attend renewal of the head; and first, the prolongation of the stem seems absolutely dependent upon it. Having lost its head, the stem to all appearance remains stationary, unless in the wound closing; but from the moment that the rising internal bud reaches the vacant extremity in its integument, the neck, or that portion sustaining the young hydra, visibly lengthens, and so continues, until further prolongation is arrested by the separation and fall of the regenerated parts. The wound cicatrizes again. If reproduction follow by another embryo rising within to issue from the summit, a new prolongation ensues also; and so on with a third, a fourth, or more. Thus are formed as many nodes or articulations of the stem.

"Prolongation of the stalk seems combined with the evolution of the hydra by one of the few invariable laws ascertained. But the irregular duration of the successive hydræ or heads produces an irregularity in the accessions to the length of the stalk. One shoot extending six or eight lines may be followed by another of only two or three; and the prolongation seems scarcely sensible where the head flourishes merely to decay. The utmost dimensions of this product are therefore as uncertain as the number of regenerated hydræ whereby they are attained. Let it be always remembered that the prolongation of the hydra's neck is the sole medium of extension of the stem." (pp. 6, 7.)

Sir John Dalyell has not been able on many trials to discover the circulation described by Lister in the stalk of *Tubularia indivisa* (p. 22), but he has seen it, and described with great accuracy its phænomena, in the *Tub. ramosa*, pp. 65 and 69. Thus the discoveries of successive observers will probably prove the circulation of a fluid in the stems to be a general law in the physiology of these zoophytes, for negative observations cannot be allowed to invalidate the positive results obtained by previous naturalists. How many have in vain tried to see the currents in the living sponge; and yet there is no fact better ascertained than the existence of these currents!

2. *Tubularia larynx.* This is very interestingly described and illustrated.

3. *Tubularia ramea.* "This," says our enthusiastic author, "is a splendid animal production—one of the most singular, beautiful and interesting among the boundless works of Nature. Sometimes it resembles an aged tree, blighted amidst the war of the elements, or

withered by the deep corrosions of time; sometimes it resembles a vigorous flowering shrub in miniature, rising with a dark brown stem and diverging into numerous boughs, branches and twigs, terminating in so many hydræ, wherein red and yellow intermixed afford a fine contrast to the whole. The glowing colours of the one and the venerable aspect of the other, their intricate parts, often laden with prolific fruit, and their numberless tenants, all highly picturesque, are equally calculated to attract our admiration to the creative power displayed throughout the universe, and to sanction the character of this product as one of uncommon interest and beauty." (p. 51.)

Very unexpectedly this remarkable zoophyte is proved by our author to belong, not to the family Tubulariadæ, but to the Sertularians, for it produces its germs in a "prolific pod" analogous to the vesicles of the *Sertulariæ*, and these germs are planules on their birth. "Only a single large, bright yellow planule is contained in the vesicle, whence it is discharged on maturity from an orifice towards one side near the summit. But the vesicle itself is of such extreme transparence that it is hardly visible after losing its contents," p. 58. Perhaps we might remove the anomaly in its present place in the system by placing the species in the genus *Thoa*, of which it has the habit.

4. *Tubularia ramosa.* The doubts which have been entertained of the distinctness of this as a species from *T. ramea* are now removed, for the two productions do not belong to the same family, the larva of the *T. ramosa* being medusiform. But its polype differs greatly from that of the genus *Tubularia* as restricted in present systems, for while the head of the latter is naked and exposed and remains so under all conditions and circumstances, this can and does retreat within the tubular extremities of the polypidom for shelter (p. 65).

5. *Hydra viridis*, pl. 12. figs. 17–20.

6. *Hydra fusca*, pl. 12. fig. 15. The only species which the author has found in Scotland. The figures are of the natural size, and very characteristic.

7. *Sertularia polyzonias.* The most complete history of the species that has been published, and the figures are entitled to great praise. We here learn that the polypes or hydræ in the cells of the polypidom may die and be replaced after their decay by others, p. 149. The following passage on the food of these zoophytes is worth extracting:—"The food of the smaller compound zoophytes is problematical; but it is obvious that all must have subsistence to sustain life and promote enlargement. I was induced by the size of the hydra here to attempt feeding them with soft particles of the mussel, a substance the most grateful of any to most of the lower carnivorous tribes; and I believe that I succeeded. I thought the particles might be discovered in the remoter parts of the stomach, whither they were transmitted by a distinct channel. There the contents appeared as a dark internal mass, becoming ovoidal, and the hydra distorted. If the particle be too large, it is retained a long

time externally; nor can it be forcibly removed without the visible reluctance of this diminutive being." (pp. 144–5.)

8. *Sertularia abietina.* A monograph of interest equal to the preceding. The figure on pl. 23 is an admirable portrait of the species. The species has "two differently formed vesicles," "a fact also incident to a few other *Sertulariæ.*" One of the vesicles is ampullate or flask-shaped with nearly white contents and numerous oviform corpuscula; the other is compound, "the spherule containing a single yellow globular corpusculum," p. 155. Here we are informed that "great diversity occurs in the shape of the same planulæ, from whatever zoophyte they come. Nothing can be more variable than their soft, extensile and contractile bodies, in motion or at rest; and according to the freshness of their element or the temperature of the atmosphere, and especially when about to undergo the metamorphosis incident to their race." (pp. 155–6.)

The following paragraph is also interesting:—"The evolution of the nascent *Sertulariæ,* from vesicles *in situ,* is a rare occurrence. We have seen that, from some unnatural retention in the cysts of the *Tubulariæ,* the organs of the young may begin to unfold. This may tend to corroborate and explain a figure given by Ellis, representing a hydra issuing from a vesicle of the *Sertularia pumila.* But it is to be noted also that examples are not wanting of portions of the *Sertulariæ* vegetating through an empty vesicle with a generated or regenerated hydra. I can account for it only from the sudden metamorphosis frequently rendering the planule motionless, and thus precluding its escape from the vesicle. But although this may ensue in the *Sertularia abietina,* the discharge of the planule from the vesicle, to undergo its metamorphosis unrestrained, is the ordinary and natural course whereby the species is perpetuated." (p. 156.)

9. *Sertularia abietinula.* This is merely an early state of *S. argentea,* so far at least as fig. 7 of pl. 25 is concerned. Fig. 6 seems to represent a small specimen of *S. abietina.*

10. *Sertularia rosacea.*

11. *Sertularia pumila.* We doubt whether figures 19 and 20 of plate 26 represent this species.

12. *Sertularia halecina* and *cognates.* The natural-sized figures of this species are beautiful and correct, but drawn from small specimens. We differ from the author in referring Ellis's *S. halecina,* as exhibited in pl. 10 of his 'Corallines,' to *Thoa Beanii*; it seems to us to be a good figure, and certainly *not* "from an indifferent drawing," of the true *S. halecina.* This is elaborately described by our author, but we cannot be brought to admit that *Thoa halecina* and *T. Beanii* are only states of one species, although the observations of Sir J. Dalyell shake our confidence in their absolute distinctness. The question is still open to future inquiry.

The following quotation describing the rapid growth of the polypes is interesting:—"Where vigorous hydræ already subsist, the regeneration of others advances in their vicinity—the clear and transparent sheath showing their progressive evolution. Nothing can be more interesting than to witness the rapid refinement of an embryo

hydra into perfect configuration, and the display of the organic parts actually completed under the observer's eye. My notice having been directed to a specimen, wherein, from the highest of three frills, a dark green globular mass rose prominent as an acorn in the cup; in an hour it became somewhat clavate, while turned slightly aside, still enlarging without any indications of tentacula. But in another hour these organs became perceptible through a very delicate transparent involucrum protecting the mass. The head had now protruded almost entirely from the frill, and the extremities of the tentacula separating, having improved the symmetry of the parts, they were gradually and at length freely unfolded two hours afterwards in their due proportions. The new head of the finest green was perhaps the fourth which the twig sustaining it had borne in succession." (p. 165.)

13. *Thoa Beanii.* Well figured and described, and its history completed by the description of the animal and of its planule.

14. *Thoa muricata.* The author has never observed "any visible object" ever discharged from the muricated vesicles of this species, though he has had many specimens at various seasons of the year, and which were preserved with every possible care. He questions whether the capsules are truly vesicles, or whether they are not rather extraneous substances—the capsules of some of the Testacea. They are certainly not the capsules of any bivalve, as suggested, but they may be those of a zoophagous gasteropod. We incline, however, to believe them integral parts of the zoophyte.

15. *Plumularia falcata.* A beautiful history of the species.

16. *Plumularia pinnata.*

17. *Plumularia ? fascis.* This is apparently a new species allied to *P. catharina.* The magnified figures are scarcely sufficient.

18. *Sertularia argentea.* The figures appear to us to represent *S. cupressina*, but the author entertains doubts whether the two be truly different, and his observations tend to prove that they are not so. The species has two sorts of vesicles, a simple one resembling a vase, and one "of compound formation, consisting of a hollow pedestal, surmounted by a sphere about three times its diameter," p. 192. The propagation is very minutely detailed.

19. *Antennularia antennina.*

20. *Antennularia ramosa.* The author has proved these to be perfectly distinct. The first has a vesicle which produces "a single yellow embryo" "so large that there seems no room for more. It is evolved as a planula, surpassing the size of any that I have seen issuing from a *Sertularia*, for it is nearly the twelfth of an inch in length," p. 201. But the vesicles of *A. ramosa* contain many—from twelve to thirty—corpuscules, and the planula is very minute, "not exceeding the sixth part of the size of the single yellow planula" of *A. antennina.* After some interesting observations, the author concludes (1.) that *A. antennina* has "a single ruddy stalk ten inches high, begirt by slender verticillate twigs, and bearing axillary ovate vesicles, each containing a single yellow planule;" (2.) that *A. ramosa* is "a greenish shrub, diverging into boughs and branches, clothed

with twigs: likewise with slender, prolonged, plumose vegetations sometimes interspersed, whereon, besides hydræ, are borne long ampullate axillary vesicles, each containing many planulæ;" (3.) that *A. ramosa* may have three vesicles all different from each other in form; (4.) "that vigorous reproductive energies reside in the *ramosa*, which are readily and frequently exhibited, while similar energies are feeble and rare in the *A. indivisa*." (p. 209.)

21. *Laomedea dichotoma*. Admirably described and figured. The cell of the polype is deciduous. The larva is medusiform, and has some resemblance to a hand-bell. "It swims by jerks, or bounds like the various species of Medusæ, from collapse of the body, perhaps aided by the tentacular organs. It pursues all directions, rising, falling, or remaining stationary in equilibrio. Like a group of the *Medusa bifida*, these creatures narrowly resemble a flock of minute birds wending their course through the expanse of the firmament." (p. 216.)

22. *Campanularia verticillata*. The margin of the polype-cell is either "plain or serrated," a remark which may tend to reconcile the discrepancies in the descriptions of some allied species. The cells are normally deciduous, falling off with the decay of the polypes. "The two are mutually dependent on each other," p. 219; the very reverse of what exists in the Sertulariadæ. The larva is a planule.

23. *Campanularia dumosa*. The generic relations of this species remain unascertained. Its structure, says Sir J. Dalyell, is very different from *Laomedea dichotoma* or *Campanularia verticillata*. The polype is a vivid grass-green. The mode of propagation is unknown.

24. *Campanularia syringa*. Another doubtful member of the genus *Campanularia*. The structure of the cell is peculiar, nor does it fall off on losing the polype. This has about sixteen tentacula. "That number has been ascertained as the complement of several. I have not observed any of the hydræ with only eight tentacula, which is in fact a very rare characteristic of any of the marine hydraoid zoophytes," p. 223.—The species which follows affords an exception to this remark.

25. *Sertularia arcta*. This is the same as the *Campanularia intertexta* of Couch. The polype has eight tentacula, and a few individuals only have ten. The larva is a planula, "but instead of being generated within a pod or vesicles as others from the hydraoidal *Sertulariæ*, its matrix consists of a congeries of cavities or compartments, as seen in the surface of the mass. An aperture being discovered in the middle of each after the planula has been discharged, we may presume that no more than one is contained in a compartment," p. 225. The production is evidently the type of an undefined genus.

We shall continue our analysis in a future number.

In the Press.

We are glad to learn that Mr. Gosse, author of the 'Birds of Jamaica,' 'Canadian Naturalist,' &c., is about to publish a series of

lithographic drawings, illustrative of the species described in his 'History of the Birds of Jamaica.' The figures will be drawn on the stone by the author himself, partly from original drawings and partly from preserved specimens, with the advantage of his own notes and personal knowledge of attitudes, &c.; and they will be very carefully coloured. The number of species proposed to be illustrated amounts to about a hundred and twenty; of which more than one-half are not figured in English works, worthy of reference, while a considerable number are new to science.

The work is to be issued monthly, and is not to exceed the extent of thirty numbers.

PROCEEDINGS OF LEARNED SOCIETIES.

COTSWOLD NATURALISTS' CLUB.

At a Meeting of the Cotswold Naturalists' Club, held at Rodborough Common, May 18th, 1847, Dr. Wright of Cheltenham exhibited a beautiful preparation of the *Geophilus longicornis*, Leach, in which he had observed the veneniferous glands of that Myriapod. He had found no description of these glands in any of the great authorities on the structure of the articulate animals whom he had consulted, from which he inferred that these bodies had hitherto escaped observation.

Dr. Wright observed that the salivary glands in the vertebrate animals are in general absent in those classes and tribes which live habitually in water. In Fishes they are absent, an increased mucous secretion being poured into the mouth by a great development of the buccal follicles. In Batrachia distinct glands are absent, a compensative secretion being supplied by the mucous glands of the mouth and tongue. In the Cetacea they exist only in a rudimentary state. Hence the conclusion that animals that seize their prey in the water and swallow it without mastication have no necessity for saliva as a preliminary solvent for the digestive process, the gastric juice in these animals being sufficient to complete the chemical changes in the stomach. In the invertebrate classes salivary glands are absent in all the Radiata, nor do we observe these bodies in the Tunicated or Acephalous Mollusca; but they are found in the Gasteropoda and Cephalopoda; they are absent in the Entozoa, but exist in a rudimental state in the Annelida and Crustacea. In all the classes of the Articulata that respire air, as Myriapoda, Insecta and Arachnida, salivary vessels can be demonstrated: these organs may be subdivided into simple and compound glands.

A. When the secretion supplied is a fluid concerned in the digestive process, the secreting organ is a simple tube with its distal extremity closed.

B. When the secretion supplied is used for the destruction of prey, the secreting organ is a compound body or gland.

In the majority of Insecta the salivary vessels are simple ramified tubes that open into the gullet, but in Hemiptera simple tubes and

glandular bodies coexist; the former I regard as the true salivary organs, the latter as veneniferous glands for the destruction of prey. In *Nepa, Notonecta, Naucoris* and *Ranatra* these bodies are beautifully developed.

In pulmonary Arachnida the veneniferous glands are situated in the cephalothorax; their excretory ducts arise from the anterior part of the gland and traverse a minute canal in the mandibles, and open at the perforated extremity of these organs.

In Myriapoda, as in the preparation of *Geophilus longicornis* now before us, the veneniferous glands lie at the base of the mandibles among the striped or voluntary muscles that occupy this region. With an inch glass we see these organs most satisfactorily; they consist of two oblong compact bodies composed of bundles of diaphanous cells closely pressed together and inclosed in a distinct capsule reposing loosely at the base of the jaws and occupying the hollow part of these organs; from the anterior part of the gland rises a single excretory duct, which passes forwards in an arched direction and enters a canal in the horny part of the perforated jaw and opens near its apex, as in the Arachnida. By this mechanism, when *Geophilus* inserts its mandibles into the body of its victim, it at the same moment introduces a poison into the wound which destroys life, after the same principle as the parotid glands in some ophidian reptiles, as *Crotalus, Naja* and *Vipera,* are metamorphosed into veneniferous glands for the destruction of living prey. After this communication was made, Dr. Wright demonstrated the preparation to the members of the Club, and exhibited the singular structure with the aid of the microscope.

ENTOMOLOGICAL SOCIETY.

January 5th, 1846.—The Rev. F. W. Hope, F.R.S., President, in the Chair.

Mr. Edward Doubleday exhibited a large web, of a delicate silken texture and four or five yards long, sent from Mexico, and intended for the collection of the British Museum, known by the name of the *Tela de Maiz,* spun by the caterpillars of some small *Yponomeuta* or *Anacampsis* over heaps of maize laid up in store.

The President exhibited a portion of Mr. Fortnum's collection of insects formed at Adelaide in South Australia, with drawings of some of the more remarkable kinds, and announced that it was intended that a share of the duplicates should be placed in the collection of the Entomological Society.

Mr. Bedell (who was present as a visitor) exhibited a specimen of *Argyromiges Roborella* of Zeller, a species new to Great Britain.

A note was read by Mr. Brayley, accompanied by a species of *Anthomyia* (*A. pluvialis,* Linn.?), observed by a druggist to settle in great numbers on the filter when he was preparing tincture of cantharides, and at no other time. They did not however come out of the cantharides.

Extracts were read from letters addressed by Mr. Benson to Mr.

Westwood, containing notices of four new species of *Paussidæ*, recently captured in India (detailed descriptions of which have been subsequently published by Mr. Benson in the Calcutta Journal of Natural History).

A decade of new *Cetoniidæ*, chiefly sent from Cape Palmas by Mr. Savage, was read by the Rev. F. W. Hope.

Mr. E. Doubleday noticed, with reference to the minutes of the meeting of the Society on the 2nd of December 1845, as published in the Journal of the Proceedings of the Society, that it is his opinion that *Papilio Ædea* of Clerck is distinct from, although closely allied to, *Eterusia pulchella*, Hope; and that in respect to their antennæ, the genera separated by Mr. Hope constitute but one genus.

February 2nd.—The Rev. F. W. Hope, President, in the Chair.

Mr. Longley exhibited a specimen of one of the species of *Ophiusa* common on the western coast of Africa, captured on the 23rd of May 1845, in latitude 24°15′ north and 24°45′ west longitude, the nearest land being the island of St. Antonio, one of the Cape de Verd islands, distant 390 miles, and the main land being 470 miles distant, the wind being from the north-east.

Mr. Bedell exhibited a specimen of *Sphinx Convolvuli*, taken on board ship on the 9th of September 1845, about forty miles from the Land's End, in lat. 49° 24′ north, and longitude about 5° 30′ west. The ship left Cadiz on her return on the 11th of August, and the wind at the time of the capture was moderate from the north-east, the insect being observed to fly from the direction of the wind.

Mr. Westwood exhibited drawings and specimens of the curious cases made by the larva of *Clythra 4-maculata* found among the debris of ants' nests, from the collection of the Rev. F. W. Hope.

The Rev. F. W. Hope read a paper containing descriptions of the following new *Coleoptera*, collected by Mr. Fortnum at Adelaide in South Australia.

Corynophyllus Fortnumi, Hope. Female: the male having been previously described and figured by Mr. Hope in the 'Transactions' of the Society.

Semanopterus, Hope. A new genus, in habit approaching *Cheiroplatys*, but distinguished by the elevated lines on the elytra and general sculpture. It possesses the grooved thorax of *Cheiroplatys*, and seems to approach *Phileurus*. The species are found under dead bark. Detailed descriptions and figures of the parts of the mouth were given.

Semanopterus Adelaidæ, Hope. *Niger, clypeo cornu brevi armato; thorace glabro in medio sulcato, sulco sparsim punctulato; elytris lineis elevatis politis, interstitiis punctulatis, punctis triplici serie impressis.* Long. corp. lin. $10\frac{1}{2}$.

Semanopterus subæqualis, Hope. *Niger, clypeo dente parvo armato; thoracis sulco haud fortiter impresso, punctato; elytris ferè æqualibus, lineis elevatis et punctis triplici serie ordinatis.* Long. corp. lin. 10.

Semanopterus depressus, Hope. *Niger, pectore pilis ferrugineis obsito; clypeo dente parvo armato; thorace sulcato, disco glabro sub lente tenuissimè punctulato; elytris lineis quibusdam elevatis, punctisque in triplici serie ordinatis; ano rubro.* Long. corp. lin. 10.

Onthophagus cereus, Hope. *Niger nitidus; antennis piceis; clypeo ferè trigono, posticè furcato, seu occipite lamina lata bicorni armato; thoracis dorso canaliculato, anticè retuso, in medio bituberculato; elytris sub forti lente lineato-punctatis.*

Onthophagus Adelaidæ, Hope. *Nigro-æneus, clypeo sub-bidentato, posticè furcato, seu cornubus duobus acutis, lateraliter divergentibus armato; thorace atro-æneo et granulatè rugoso; elytris depressis, sub lente striato-punctatis.*

Aphodius Adelaidæ, Hope. *Niger nitidus, clypeo subemarginato; antennis atris; thorace glabro; elytris sub lente striato-punctatis; corpore infra nigro; femoribus tibiisque rubro-piceis.*

Aphodius cincticulus, Hope. *Affinis* A. anachoretæ, Fab. *Capite nigro subemarginato, anticè flavescenti, tuberculo unico armato; thorace atro nitido, margine omni pallescente, scutello flavo; elytris striatis, fusco-flavis, margine flavescenti, sutura nigra.*

Aphodius sculptus, Hope. *Niger, antennis flavo-piceis; clypeo emarginato; thorace varioloso-punctato; elytris lineis elevatis glabris intermediis sculptilibus; corpore infra atro nitido, pedibus concoloribus.*—Port Philip.

Aphodius Tasmaniæ, Hope. *Fusco-brunneus, clypeo integro vix reflexo; thorace nigricanti punctulato, margine omni pallescente; elytris striato-punctatis fusco-brunneis; corpore infra concolori, pedibus flavescentibus et ciliatis posticis longissimis.*—Van Diemen's Land.

Aphodius Howetti, Hope. *Præcedenti affinis, at minor. Fusco-piceus, clypeo integro vix reflexo; thoracis disco nigricanti punctulato, margine omni rubro-piceo; elytris striato-punctatis atro-piceis; corpore infra flavescenti, pedibus concoloribus.*—Port Philip.

These descriptions were accompanied by some verbal observations on the Stercorarious beetles of New Holland. Mr. Fortnum stated that the *Aphodiidæ* which he had observed possess the same habits as the *Melolonthidæ* in England in flying by night, and that they are found in human fæces, but are never met with more than five miles from the coast. Several species of *Onthophagi* are also found in human fæces.

Mr. E. Doubleday observed that he had noticed the small *Onthophagi* in North America upon bones; and in allusion to the attraction offered to insects by putrid fungi as well as decaying animal matter, he stated that in some parts of Peru the splendid butterflies of the genus *Morpho* are captured in great numbers upon rotten fungi, and are used to decorate the altars of the churches on saints' days and great festivals.

Mr. Spence stated, that from his own observations he was inclined to think that a much higher degree of instinct had been attributed to the sacred beetles than they really possessed. He had observed

them in Italy for a long time, and had never observed that they formed a hole previous to rolling their balls; and that instead of assisting one another, the whole scene was one of confusion, each individual endeavouring to appropriate whatever it could to its own purpose. Mr. E. Doubleday also stated that his own observations on the tumble-dung beetles of North America coincided with those of Mr. Spence, and that he had never seen any pitfall formed, but that the insects sunk their balls in the same way as the *Necrophagi*, by merely scratching the earth from beneath them.

March 24th.—The Rev. F. W. Hope, President, in the Chair.

Two boxes of Lepidopterous insects, sent from Ceylon by R. Templeton, Esq., were exhibited by Mr. Westwood.

Mr. J. F. Stephens exhibited a pupa-case of the emperor-moth of an irregular form, being nearly twice the ordinary size, and having the appearance of being double, from which however only one moth had been produced.

Captain Parry exhibited living specimens of a new species of *Ditomus*, which he had received inclosed in quills transmitted by post from Lisbon.

Mr. S. Stevens communicated the following new and very effective method of relaxing insects:—"I procure about a dozen shoots with the leaves of the common laurel, the younger the better, put them into a coarse bag or cloth (shot bag I use), bruise them well with a wooden mallet till the bag becomes quite moist, then put it into a glazed jar or other large vessel, and stick the insects on the top of the bag, which must be tied over with a bladder, or secured in some way so that it is perfectly air-tight. Twenty-four hours is generally sufficient to relax most insects; but one great advantage is, that if they remain a week or ten days in the laurel, it does not in the least injure the specimens, so that they can be set out at any convenient opportunity. It also completely destroys the mites or mould, if the specimens happen to be infested; and it will be found to have many very great advantages over the old plan of damp sand or flannel. I was in hopes, from experiments that I made on two or three green species, that the colours would not fly; but I since regret to find on further trial, that *Hipparchus papilionarius*, *Hemithea vernaria* and *Cythisaria* are considerably changed by it. Mr. Dale informs me it answers equally well with the other orders, he having relaxed nearly the whole of his dragon-flies; and it is much used at Bristol for the *Hymenoptera*: it also effectually relaxes the skins of birds, and kills the vermin much better than camphor."

Mr. Marshall mentioned that a compound formed of one drachm of corrosive sublimate to eight ounces of the strongest alcohol was the most effectual remedy, when washed over an insect, against the attacks of mites, &c.

Mr. Hope read a paper containing descriptions of some new species of Australian *Buprestidæ*.

Mr. Westwood exhibited drawings of two very splendid *Chalcididæ*, forming a new genus, from Adelaide, collected by Mr. Fortnum.

Mr. Douglas read a series of observations suggested by, and in opposition to, the views concerning insect life published by Dr. Badham.

April 6th.—W. Spence, Esq., F.R.S., in the Chair.

A letter was read from Sir Gardner Wilkinson, thanking the Society for his election as a corresponding member.

Captain Parry exhibited a box of insects recently obtained from the Gold Coast, including many rare and interesting species, as well as specimens of *Goliathus Cacicus*; a locality worthy of notice, as Mr. Savage had stated his opinion that the Gold Coast was the region of *G. Drurii*, and the Grain Coast that of *G. Cacicus*.

Captain Parry also exhibited some heads of seeds similar to that of millet, obtained from the interior of South Africa, 300 or 400 miles from the Cape of Good Hope, nearly every seed of which was infested by a living specimen of a small *Calandra* allied to *C. oryzæ*.

Mr. F. Bond exhibited a specimen of *Phryxus Hippolytes*, a remarkable parasitic crustacean allied to *Bopyrus*, recently described by Rathke in the 'Nova Acta,' and which had been found beneath the abdomen of a white shrimp (*Pandalus annulicornis*) on the coast of Sussex.

Mr. E. Doubleday exhibited a new species of the genus *Papilio*, *P. Dionysus*, Doubl., allied to *P. Hippocoon*, from the coast of tropical Western Africa, from the collection of Mr. Loddiges.

Mr. Ingpen exhibited a specimen of a species of *Polistes* from Mexico, from the body of which several filamentous fungi had vegetated; likewise the nest of the campanular wasp of Britain.

Mr. S. Stevens exhibited a specimen of a new British moth, *Graphiphora tristigma*, Ochsenheimer (but not of Stevens), allied to *Gr. triangulum*, which he had reared from a caterpillar found feeding by night on the blossoms of the sallow in April 1844 at Weybridge, as Mr. Stevens believes. The insect hitherto known in this country under the name of *tristigma* is distinct, and is the *Noctua rhomboidea* of Esper and Ochsenheimer. He also exhibited specimens of *Orthosia leucographa*, *rubricosa*, *munda*, *miniosa*, *Calocampa exoleta*, and *Xylina rhizolitha*, taken this spring from the blossoms of the sallow in the neighbourhood of Dorking; also *Orthosia munda*, *populeti* and *Calocampa vetusta* from Wimbledon Park, having captured these insects (in consequence of the mildness of the season) a month or six weeks earlier than he took them last year.

Mr. Doubleday also exhibited, in behalf of Mr. Angus, a new genus of butterflies captured in New Zealand by that gentleman, allied to *Polyommatus*; also another new genus allied to *Agarista*, from the same island.

The following memoirs were read:—

"A Monograph on the genera *Pseudomorpha*, *Adelotopus*, &c." By J. O. Westwood, Esq., F.L.S.

"Descriptions of some species of *Oiketicus* from the island of Ceylon." By R. Templeton, Esq.

"Descriptions of three new exotic Insects." By A. White, Esq.,

since published in the 'Annals of Natural History,' by whom also some observations were made on the geographical distribution of insects in North America as compared with New Zealand.

May 4th.—W. Spence, Esq., F.R.S., Vice-President, in the Chair.

The Secretary announced that the Address delivered by the President at the last anniversary meeting had been printed and was ready for delivery.

Mr. Moore, jun., exhibited some foreign beans attacked by a larva which had eaten through them, spinning its web for a passage.

Mr. S. Stevens exhibited a specimen of *Deilephila lineata*, taken at Hammersmith on the 16th of last April; also a specimen of *Cleora pictaria*, found on palings at Dartford Heath on the 12th of last April. It was also stated that specimens of *D. lineata* had been taken at Langport, Somersetshire, and by a nurseryman at Bristol in the past month of May, as well as a specimen of *D. Celerio* at Manchester.

He likewise exhibited the larvæ of *Polia tincta* and *Tryphæna fimbria*, both found on the birch at Birchwood at the beginning of May.

A memoir by W. W. Saunders, Esq., containing descriptions of some new species of Australian *Chrysomelidæ*, was read.

June 1st.—Thomas Marshall, Esq., Vice-President, in the Chair.

Mr. S. Stevens exhibited a second specimen of *Deilephila lineata*, taken at Hammersmith a short time previously; also several cases of a tough leathery texture, formed by a lepidopterous larva which eats through the base of the horn of the two-horned rhinoceros, from Southern Africa.

He also exhibited some twigs of oak from Darenth, Kent, completely defoliated by the small green *Tortrix viridana*, which was extraordinarily abundant this season.

Mr. Ingpen exhibited a case of insects from Adelaide, including various rare and interesting *Coleoptera*, *Psychopsis mimica*, &c.

Mr. Harrington exhibited various splendid *Coleoptera* from the Himalayan range of India, including the male of *Cheirotonus MacLeaii*, Hope, &c.

Mr. Moore, jun., exhibited a cocoon of *Eriogaster lanestris* of a globular form, which on being opened was found to contain two male chrysalides; and Mr. Weir mentioned that he had observed the same circumstance several times in the same species, as had also Mr. Longley.

Mr. Westwood exhibited specimens of a minute species of the Dipterous genus *Phytomyza*, the larva of which mines within the leaves of the holly, causing large unsightly blotches upon them, and which had occurred in great profusion this spring. He had also reared a small parasitic Ichneumon from the leaves, which keeps the *Phytomyza* in check. He also exhibited specimens illustrating the history of the minute moth *Argyromiges Blancardella*, the larva of which mines the leaves of the evergreen oak, the chrysalis pushing itself half through a hole which it forms in the leaf in order to effect

its escape. He had also reared the parasitic Ichneumon attached to this species. He also exhibited specimens of the *Coccus manniparus* of Klug, brought from Arabia by Ehrenberg, as well as some manna brought from Mount Tabor by Lieut. Wellstead; and exhibited specimens of the *Womela*, an analogous secretion formed upon the under sides of the leaves of the various species of *Eucalyptus* in New South Wales by a minute species of *Psylla*, numbers of which were found secreted amongst the *Womela*. Mr. Westwood had been informed by Mr. Gould, that for several months last year this secretion formed a large portion of the food of the natives. The insects are attacked by a minute and very beautiful parasite of the genus *Encyrtus*. Mr. Harrington also stated that the genus *Eurymela* produces a kind of manna on the *Eucalypti*, and which falls to the ground in the shape of small white crystals.

A letter was read from W. Spence, Esq., inclosing an extract from a letter from his son R. Spence, Esq., giving an account of the discovery, by Professor Schiodte, of as many as twenty species of blind insects of different orders and genera, all new, in the caves of Styria; so that it would appear that there exists a subterranean fauna of blind animals. Ten of the insects were Coleopterous. It was mentioned that a Carabideous genus without eyes has lately been described by the German naturalists, and that various blind insects and spiders had been found in the mammoth-caves in Kentucky. (See Dr. Erichson's 'Bericht' for 1844.)

An extract from a letter addressed by Captain Boys to Mr. Westwood was read, giving an account of the habits of some Indian species of ants, white ants, and other insects:—

"On our way down towards Sukker, I observed what I consider an undescribed species of *Termes*, of an unusually large size, of which I made a note. The workers alone are nearly half an inch long. I never saw such monsters. The nest is peculiar. From the surface of the plain on which I observed these nests, which are conical in form, little hillocks of about six inches high were seen at various distances from each other, from five feet to twenty apart. These were composed of grains of earth worked up to about the size of millet seeds, and were quite loose, and might be taken up in handfuls. Inside each of these heaps, a raised structure, branching off in three or four short arms, was to be found, with an internal passage from the surface of the earth to each branch: but how the creatures contrived to cover the whole without appearing outside is left to conjecture. The apex of each cone was about three-quarters of an inch from the arborescent-looking structure inside. The latter was also composed of small pellets of earth, but half as fine as the superincumbent grains, and were moreover glued firmly to each other. I removed the earth from the outside of several nests, and blew away all the pellets, leaving only the stump sticking erect from the earth. At the top of the latter and at the end of each branch was an orifice,—the continuation of the internal canal. In about ten minutes hosts of the inhabitant ants came up with earth freshly manipulated, and began pouring their pellets out of each orifice: the latter of course

were carried by their jaws. I sat observing them for about an hour, when I marked the spot and returned to camp. In the afternoon, on my return to it, all the stumps were again covered over.

"The red ant you mention as having been described by Colonel Sykes is, I think, familiar to me. I allude to an ant of about four lines long which builds a beautiful nest in trees, mostly in a mango-tree. The nest is composed internally of a web much resembling that of the earth-spider, but much closer, and infinitely stronger in texture. The outer portion of the nest is a thatch of leaves, brought together by main force, and joined one to another by the forementioned web. I have seen nests almost as round as footballs, and quite as large. The mango-tree has its leaves long and oval, similar in shape to each segment of the casing in a tennis-ball, and the end of each branch bears a bunch of leaves (in a circle) to the number of eight or ten: however, these leaves are depressed and brought together in an admirable manner. The web bears writing on with facility, and the insect in the winged state is green. The bite of the worker is severe; and the scent of the formic acid, when the nest is interfered with, is so strong as to be almost insupportable.

"There is also a black ant which forms its nest in trees, in the Himalayas above Kimaon, but I have not studied their habits. The nest looks like an agglomeration of sawdust.

"Of *locusts* there are undoubtedly two species, exceedingly distinct, and which migrate in swarms, doing intense damage:—one, a pink underwinged kind with fuscous patches on the upper wings; the other with yellow underwings, and in other respects nearly similar, except that instead of being tawny it is of bright yellow, and which is far more common than the former. Again, there are three other species which are not so abundant, but still do much damage. These I have only observed in loose flocks, and have never taken them in the larva state. The whole country has suffered severely from the ravages committed by the two first species noticed, during the greater portion of last year and the latter end of 1843. The *pink underwing* species were so numerous in the terrai at the foot of the Himalayas near Bennourie, on the road to Almorah, that the branches of shrubs and trees on which they settled were completely hidden by them, and twigs a finger thick broken down by their weight alone. The ground one brickdust red. I observed these wretches in flights extending for miles, so thick as absolutely to obscure the sun, and cause some difficulty to my palanquin-bearers in getting through them, as at every step they rose in swarms, striking and flying against the men's faces in every direction. This was in the middle of October in 1843. Several large flights of the yellow kind I had observed a month or six weeks previously at Almorah. Of the pink description the colour is more or less intense according to age, or quantity of rain they may have been exposed to. In fresh or lately matured insects the underwings are a very pale pink, and the outer ones not much darker. In old and tough specimens these latter organs become a dirty claret and water colour, inclining to Indian red. Of the *yellow kind* I obtained the larvæ in abundance at Nus-

seerabad in the latter end of July 1844, though I had never previously seen the insect in this state during nineteen years' sojourn in India. They were as numerous as their parents, swarming on every bush, and crawling all over the ground for miles among the hills near the above-named cantonment (these hills are a portion of the Aravalli range which rise near Delhi). The larva is very handsomely marked with orange-yellow and black; the face, if I may so term it, is bright orange-yellow, the portion behind and below the eyes a dark maroon. Legs (posterior ones) bright yellow banded with black; winglets light yellow, faintly striped with dusky connected spots. Antennæ black, with the two first joints yellow. But nothing but a correct delineation, or the insect itself, can give a just idea of its handsome markings.

"The two specimens now forwarded of a new species of *Colias*, together on one card, are, I am strongly inclined to think, different only in sex; and I consider the white as the male, having observed it hovering over the red. And besides this, I have been led to the conclusion by the fact, that for one red I took at least five white. The tree jungle about the place is called the Peeloo: its technical name is unknown to me; but the wood is held in high esteem by the natives for the purpose of making tooth-brushes.

"I have two species of *Celyphus* from Mhow in Malwa; one a bright bottle-green, the other darkish brown: the smaller species is about three lines long, the other a line longer. They resemble some of the *Fungicolæ*, but are rather longer in shape. The hard case (beneath which the wings are distinctly visible and extrude over the abdomen) is very like what obtains in many species of *Scutelleræ*."

A letter was read from Mr. Boreham, suggesting that the colours and forms of larvæ might possibly be preserved by inclosing them in glass tubes hermetically sealed from which the air had been extracted.

Mr. White read the descriptions of several new exotic *Hemiptera*, since published elsewhere, and alluded to the alteration produced by desiccation in metallic coloured insects, whence a species of *Callidea*, described under the name of *purpurea* by Mr. Westwood, was, when alive, of a metallic green. Spirits of wine, warm water, or æther were equally efficacious in restoring these colours after death. Mr. White also stated that Mr. Walker was engaged upon a work on the British *Aphides*, to be published by subscription.

MISCELLANEOUS.

MR. CUMING'S COLLECTION OF SHELLS.

We have learnt with much gratification that the Trustees of the British Museum have resolved to recommend to Government the purchase of the well-known conchological collection of Hugh Cuming, Esq., F.L.S. We trust that no motives of mistaken economy may operate to frustrate this resolution. Its import-

ance in the advancement of the scientific character of the National Collection of Zoology every naturalist, and especially that large class of the cultivators of science who are interested in the progress and application of conchology, must fully appreciate. We have endeavoured to obtain information as to the present extent and scientific value, as well as facts regarding the history of the formation of Mr. Cuming's remarkable collection, and we have been favoured by the following letter on the subject from Prof. Owen, who was one of the trustees of Mr. Cuming's museum during his absence in the Philippine Islands, and who has described the anatomy of some of the rarer animals of the shells in the Transactions of the Zoological Society.

To Richard Taylor, Esq., F.L.S. &c.

My dear Sir,—I send agreeably with your desire the following sketch of the nature and extent of Mr. Hugh Cuming's conchological museum, and I can only regret that my time will not permit me to do more justice to a subject on which all naturalists, and those more especially who are engaged in the advancement of conchology, and concerned in its important relations to other branches of science, must feel deeply interested.

The Memorial on the Cumingian Collection of Shells, signed by naturalists, geologists and comparative anatomists, which was communicated to the Trustees of the British Museum, on the occasion of the proposition for the sale of the collection made by Mr. Cuming in 1846, well described its important scientific value and applications.

At present the collection contains upwards of 19,000 species or well-marked varieties; and these are represented by about 60,000 specimens. Not only is every specimen entire, but choice and perfect of its kind, as respects form, colour, texture and other characters that give it value in the eyes of the practised shell-collector.

In affirming from my own personal knowledge, and from authentic sources of information, that no public collection in Europe possesses one-half the number of species of shells that are now in the Cumingian collection—one-third the number would be the correct statement as regards the national museums in Paris and Vienna—you may judge of the vast proportion of rarities and unique specimens possessed by Mr. Cuming. It is this which has given him for some years past the command, so to speak, of all the conchological cabinets in Europe. He is better known, and his labours more truly and generally appreciated, in any city or town in Europe having a public natural-history museum and its zoological professor, than in busy London.

Mr. Cuming, in his annual visits to the continent, carries with him the inferior duplicates of his rarities, representing species, with the sight of which the eyes of the foreign naturalist are gladdened for the first time. They open their treasures to him in return, and from most of the collections of Europe Mr. Cuming has borne away

the prized species or specimens in exchange for the still rarer and more valuable shells, which his abundance has enabled him to offer, without detriment to his own rich stores. The mode in which Mr. Cuming has obtained this conchological wealth is as novel and exemplary as the result is important and marvellous, considered as the work of one individual.

Not restricting his pursuit to the stores and shops of the curiosity-mongers of our seaports, or depending on casual opportunities of obtaining rarities by purchase, he has devoted more than thirty of the best years of his life in arduous and hazardous personal exertions,—dredging, diving, wading, wandering,—under the equator, and through the temperate zones, both south and north, in the Atlantic, in the Pacific, in the Indian Ocean and the islands of its rich archipelago, in the labour of collecting from their native seas, shores, lakes, rivers and forests the marine, fluviatile and terrestrial mollusks, 60,000 of whose shelly skeletons, external and internal, are accumulated in orderly series in the cabinets with which the floors of his house now groan. I never think of the casualty to which such a collection in such a place is subject without a shudder.

The result of this personal capture of the chief bulk of his collection is, that he has been enabled to assign to each shell, not only its country or 'habitat' in the ordinary zoological sense, but all the circumstances in which it lived and was developed: if a land-shell, *e. g.* its favourite rock, or herb, or tree; if a water-shell, the kind of water; and if marine, the depth and the nature of the sea-bottom at which the mollusk resided, the rock that it bored, and the animals, the weeds or other substances it devoured.

The importance of these particulars will be peculiarly appreciated by the palæontologist, on account of the insight they afford into the habits and habitat of the fossil shells of the same or allied species; and perhaps one of the most striking points in the scientific value of an extensive collection like Mr. Cuming's arises out of its relation to the present active pursuit of geology, as an indispensable instrument to the determination of fossil shells. It is unnecessary to dwell on the importance of well-determined fossils, and especially shells, to a right knowledge of the relative age and position of the stratum in which they were imbedded. Our confidence in theories or deductions based upon fossil conchology must be in the ratio of the extent of the comparison with recent shells that has been gone through in the determination of fossil shells, and especially before sentence of extinction is pronounced upon a species.

The geologist therefore from scientific motives, and the statesman on economical grounds, are alike concerned in securing for the national zoological collections the completest possible series of recent shells, as forming an indispensable instrument in the scientific exposition of the structure and riches of the earth. As such, I believe Mr. Cuming's collection to be the best and most complete that has hitherto been made.

This however is but one of its scientific uses. From the period

when the Atlantic, American and Polynesian departments of this collection reached England in 1831, scientific conchologists have there found subjects without intermission for their descriptions; and the novelties were far from being exhausted, when Mr. Cuming, having undertaken a third voyage in prosecution of his favourite science, returned in 1840 from Manilla, freighted with the conchological riches of the Indian Ocean, which have subsequently kept the pens of competent describers of new genera and species actively at work, and will so supply them for years to come: thus the Cumingian collection has directly advanced the science of conchology in an unexampled degree, and possesses the same peculiar claims upon the Government and Custodians of the National Museum in this country which Linnæus's Herbarium did upon the Swedish State. Mr. Cuming's collection contains, for example, the originals from which many hundreds of new species of shells have been described in the scientific periodicals or systematic works published since its arrival in this country.

Any doubt that may arise through the incompleteness of the description, or from the inapprehensiveness of the student, may be decided at once by reference to the original specimens. These 'types of the species' become therefore an instrument of great importance to the progress of the science in the country in which they are preserved and made accessible. The price asked by the executors of Linnæus was deemed by the authorities in Sweden too high for the great botanist's dried herbs, and you well know what happened. When better knowledge and consideration had awakened a due sense of their value, it was too late; an enterprising Englishman had struck the bargain with the widow. The Swedish government sent a frigate in chase of the vessel on board which Sir James Edward Smith had embarked the precious herbarium, but without success. It now forms the choicest treasure of the museum of the Linnæan Society, and continues to be of peculiar value as affording botanists the means of ascertaining with certainty the synonyms of the writings of Linnæus.

An English naturalist may be pardoned for citing this well-known incident in the light of a warning, when further delay in securing for the nation the Cumingian types of new species of shells may involve the necessity of crossing the Atlantic in order to compare and verify the descriptions and synonyms of Broderip, Sowerby, Gray, and other eminent conchologists.

To the physiologist the Cumingian collection has a value beyond any other now in Europe, from the circumstance of its possessor having endeavoured to exemplify each species by a series of shells of different ages, as well as by the chief varieties which result from the influence of peculiar external circumstances.

The extent to which Mr. Cuming has carried out this truly philosophical aim of elucidating his favourite department of nature is very remarkable, and renders his collection most important and suggestive in its bearings upon the higher generalizations of zoological science, touching the nature of species and the circumstances and

condition under which specific characters, or what are so deemed, become modified.

The bearing of the phænomena of development upon the solution of the great problem of the natural system of classification is rapidly becoming appreciated, and day by day the inadequacy of a single adult specimen, or pair, for the scientific illustration of a species is becoming more obvious, but especially in the department of conchology.

I could say much more on a theme so suggestive as the collection of shells now offered to the British Museum by Mr. Cuming, but I fear that I have already trespassed too long on your attention in adverting to the more prominent features of its scientific character. Of its money value I cannot speak from my personal experience as a collector, but of all objects of natural history shells are those of which the current or market-price is most easily determined. Their texture, durability and colour give them something of the character of precious stones, and one molluscous production, the pearl, takes rank among the gems of price. The value of a shell, as of a jewel, depends, no doubt, much upon its rarity, and is to that extent artificial. The *Concha unica* which today commands the sum of twenty pounds, shall next week, when a score of specimens have come into the market, fall in price to as many shillings. Still, the commonest exotic shell, if it be perfect and well-coloured, and taken from a living mollusk, as is the case with the Cumingian collection, from which ' dead ' shells have been strictly excluded, finds its market.

I am given to understand, by competent authorities, that the sum of £6000, asked by Mr. Cuming in 1846, does not exceed two-thirds of the most moderate estimate of the present market value of his subsequently augmented collection. That ten times that sum would not bring together such a series as Mr. Cuming has offered to the British Museum, I do firmly believe, from a knowledge of the peculiar tact in discovering and collecting, the hardy endurance of the attendant fatigue under deadly climes and influences, and the undaunted courage in encountering the adverse elements, and braving the opposition of the savage inhabitants of seldom-visited isles, which have conduced and concurred to crown the labours of Mr. Cuming with a success of which his unrivalled collection is a fitting monument, and of which science, and, let us hope, its cultivators in his native country more particularly, will long continue to reap the benefits.

Believe me, my dear Sir, yours sincerely,

Royal College of Surgeons, January 1848. Richard Owen.

SAGINA CILIATA (FRIES).

This curious little plant was found near Thetford in Suffolk by the Rev. W. W. Newbould on June 6, 1847. It agrees so nearly with the description and specimens of Fries that I have no doubt of its identity with his plant. The differences are, that its stems are erect rather than diffuse, and the leaves are nearly or quite devoid of cilia; both of which seem rather the marks of a variety than of specific

distinctness. Concerning the latter, Fries himself, when writing about *S. ciliata*, says, "cilia foliorum plus minus distincta, sæpe decidua:" he also says, "capsula . . . matura nutans," but his own specimens show that this is too strong an expression; for although nodding whilst the fruit ripens, they become erect at the time of maturity when the capsule opens and the seeds are shed. *S. patula* (Jordan), Obs. sur Pl. Nouv. de la France, i. t. 3, is very similar to our plant, but differs by having numerous gland-tipped hairs on its sepals and the upper part of the peduncle. To it probably belongs the *S. ciliata* of Reichenbach, both of his 'Fl. Excurs.' and 'Icones Plant.' v. tab. 200. f. 4956, and *S. depressa*, f. 4957, unless the protruded capsule of the former should be considered as distinguishing it. Neither of them can be the *S. ciliata* of Fries, since they are both figured and described as having glandular-pilose peduncles and calyx. The following seems to be the distinctive character of our plant:—

S. ciliata (Fries!); stem elongated, branches diffuse or ascending, leaves linear awned, *outer sepals acute* longer than the petals and shorter than the capsule, apex of the peduncles reflexed after flowering ultimately erect.—Sven. Bot. t. 562, not *Reich.*—Glabrous; central stem elongated and fertile. Leaves with or without cilia at their base, tipped with a long bristle. Calyx of mature fruit adpressed to the capsule. Tubercles on the seeds blunt.—The figure quoted above from the 'Sven. Bot.' is far from good. It represents all the sepals as gradually narrowed into a long acute point. Not so the specimens published under Fries's own superintendence (Herb. Norm. Suec. i. 42), which resemble ours in this respect, having two shortly acute sepals and two only pointed or cuspidate ones.—C. C. B.

CAREX BRIZOIDES (LINN.).

I am indebted to Mr. William Stevens of the Drumlanrig gardens for specimens of this addition to the flora of Britain, which was discovered in July 1844 by Mr. W. MacIvor in Studley Wood, Yorkshire. Its specific character may be stated as follows:—*C. brizoides* (L.); spikelets several all simple contiguous sterile at their base alternate in a simple spike, stigmas 2, fruit lanceolate plano-convex bifid at the end serrated from near the base, nut (elliptical beaked and stalked?), glumes rather shorter than the fruit, *root creeping*, bracts short or none.—Reich. Icon. Fl. Germ. viii. tab. 207. fig. 548; Hoppe Car. Germ. in Sturm Deutschl. Fl. tab. *a*. 23.—Stem a foot high. Glumes acute, silvery brown. Leaves long, slender, equalling or overtopping the spikes. Rhizoma creeping extensively. —C. C. B.

Some Contributions to the Natural History of the Rafflesia Patma. By M. Zollinger, M. Bat. Soc. &c.

This flower, which still continues a problem in botany and a rarity in the collections of botanists, appears not to be so scarce as has hitherto been believed. I know that it occurs on the south coast of Java on the hills near the boundaries of the Residencies of Passarúwan

and Bezúkie; I found it also on the mountain Watargan near Puger, on the south coast of the division of Bondowosso. The flower was brought to me from Jengawar in the same division. All these places lie in the lime formation, and I consider that the *Rafflesia* is an exanthem of the roots of *Cissus scariosa*, Bl., and may occur wherever its mother-plant grows. It is still uncertain whether my specimens belong to the species which Blume found on Nusa Kambangan. Blume's specimens must have been larger. The largest I possess do not attain so much as a foot in diameter, and mostly only $\frac{1}{2}$–$\frac{3}{5}$ f. This plant probably occurs also on Nusa Baron, and, it is likely, along the lime hills which nearly surround the whole south coast of Java. I have often seen on one root of *Cissus scariosa* three or more Rafflesia. It does not occur on the sand of the coast, as many believe and assert, but mostly in the ravines and humid hollows of the lime rocks. The Javanese of Eastern Java name this flower *Pidh mo*, or *Pidehmó*. It is scarcely possible to conceive what idolatrous notions are entertained concerning the flower by this people. An ordinary man would not be able to find it until after he has fasted and prayed or been sanctified when he goes to search for it. The flower is prepared with other articles as a medicine which is used after delivery by women, in order completely to purify the matrix. It is also amongst the most reputed aphrodisiacs of the Javanese, although only for women of the higher classes. Common women would be taken sick were they to use this medicine. It is further said, that if a woman of the people has recourse to it, and afterwards going out on foot treads on some dirty place, she will ever after forfeit the inclination of all men. The Javanese reckon the *Rafflesia* properly amongst the fungi, an opinion which is partly received in science; at least in so far, that we have placed the plant in the natural system as a link between the sponges and the higher plants.—*From the Journal of the Indian Archipelago and Eastern Asia for Aug.* 1847.

On the Gamboge of the Tenasserim Provinces.
By the Rev. F. Mason, A.M.

In conversation with a distinguished medical officer, and member of the Asiatic Society, I found that he was not at all aware that the Tenasserim Provinces produce Gamboge. It has therefore occurred to me that a brief notice of the Gamboge of these provinces might not be unacceptable to the readers of the Journal, and would contribute its influence to draw attention to a most interesting portion of the British provinces in the East; one that is exceeded by few in the richness and variety of its natural productions.

Three works in my possession describe Gamboge each as the product of a different tree; a fourth represents all to be wrong, and a fifth suggests a different plant still. One refers it to *Cambogia gutta*, a plant which, as described by Linnæus, has probably no existence. He described a Ceylon plant; and it is now quite evident, says Dr. Wight, "that the character of the flower and ovary is taken from one specimen, and that of the fruit from a different one, owing to

the imperfection of his specimens, and his not being aware that the lobes of the stigma afford a sure indication of the number of cells of the fruit."

Another refers it to *Garcinia cambogia*, but Dr. Wight says that the exudation of this tree is "wholly incapable of forming an emulsion with the wet finger," a statement which the writer knows to be correct. The tree is very common in the Tenasserim Provinces, but the bright yellow exudation it produces is certainly not gamboge.

A third refers it to *Stalagmitis cambogioides*, but Dr. Wight remarks, "The juice of this tree differs so very widely in its qualities from good gamboge, that it can never be expected to prove valuable as a pigment."

Dr. Graham has described a Ceylon tree under the name of *Hebradendron cambogioides*, which is said to produce good gamboge; but no gamboge has ever been exported into the English market from Ceylon. Thus it would appear, to use the language of Dr. Wight, that "the tree, or trees, which produce the gamboge of commerce is not yet known."

Dr. Helfer, who was employed by Government as a scientific naturalist, in these provinces, at an expense of *thirteen hundred* rupees per month, reported, "The gamboge of this country dissolves very little with water, and consequently does not yield that yellow emulsion as the common *guttifera*. It will never serve as a colour, but promises to give a very beautiful varnish." This statement was controverted by a writer in our local periodical at the time, who said he had obtained "fine gamboge of the very best description" from our jungles; in which he was no doubt correct, but he erred when he added that it came from the "true *Stalagmitis cambogioides*." A very small amount of botany would have served to preserve him from falling into this error; for that plant has a quinary arrangement of its flowers, while the arrangement of the flowers in those that produce gamboge in these provinces is quaternary.

The hills that bound the valley of the Tavoy river, on both sides, from their bases to their summits, abound with a tree which produces a fine gamboge. It is Roxburgh's *Garcinia pictoria*, which he knew produced gamboge, but which he said was liable to fade. As soon as I satisfied myself of the identity of the trees by an examination of the inflorescence of our plant compared with Roxburgh's description, I coloured a piece of paper, one band with this gamboge, and another with the gamboge of commerce; and subsequently exposed both to the weather equally for more than twelve months, but without being able to discover that one faded any more than the other. South of the latitude of the mouth of Tavoy river, and throughout the province of Mergui, there is found on the low plains at the foot of the hills, and on the banks of the rivers, almost down to tide waters, another species of *Garcinia* that also produces good gamboge. I have no doubt but it is the tree from which Dr. Griffiths furnished Dr. Wight with specimens, and which the latter says, "I refer doubtfully to Wallich's *G. elliptica*." We will call it then *G. elliptica*, a species which Dr. Wight has on his list of "species imperfectly known."

The foliation and female flowers are however very well described, and to complete the description I may add, the male flowers are pedunculated, but the peduncles are shut, and they might be characterized as subsessile. The anthers, like those of the female flowers, are sessile, depressed or flattened above, and dehisce circularly. The ripe fruit is globose, and not furrowed. As I send along with this paper specimens of both the male and female flowers, any of your botanists will be able to correct me at a glance, if I be in error.

Neither Wallich, Wight, nor Griffiths appear to have been at all aware that this species produces gamboge. Dr. Wight, in a recent number of his 'Neilgherry Plants,' says, "Two species of the genus *Garcinia* are known to produce gamboge; most of the others yield a yellow juice, but not gamboge, as it will not mix with water." The species which he has described as producing gamboge, and to which I suppose he refers, are *G. gutta* or *H. cambogioides* (Graham) and *G. pictoria* (Roxburgh). That others may be enabled to judge of the character of the gamboge produced by this tree, I have the pleasure to send specimens of its exudation. In its appearance to the eye, and in its properties as a pigment, I have failed to discover the slightest difference between it and the gamboge of commerce. It serves equally well to colour drawings; the Burmese priests often use it to colour their garments, and the Karens to dye their thread. It is also used by the native doctors in medicine, but I think not extensively. Dr. Lindley, in his new work the 'Vegetable Kingdom,' says, "The best gamboge comes in the form of pipes from Siam, and this is conjectured to be the produce of *Garcinia cochinchinensis*." As *G. elliptica* is spread all over the province of Mergui, is it not probable that it extends into Siam, and that the Siamese gamboge is the produce, a part at least, of this tree?

There are several other species of *Garcinia* indigenous to the Provinces, but I know of no others producing anything resembling gamboge, except *G. Cambogia*; the exudation of which, though it will not dissolve in water, dissolves in spirits of turpentine, and forms a very beautiful yellow varnish for tin and other metallic surfaces.—*Journal of the Asiatic Society of Bengal for July* 1847.

ON THE FOSSIL VEGETATION OF ANTHRACITE COAL.

Mr. J. E. Teschemacher, at the recent meeting of the American Association of Geologists and Naturalists, read a paper on this subject, confining his observations to the remains of vegetation found in the *body* of the coal, apart from that in the accompanying shales. The principal points of the memoir were, that the remains of the larger forms of the coal epoch, as well as of the smaller plants, were abundant in the coal, contrary to the usual opinion. Specimens were exhibited from the interior of the coal, showing the external and internal parts of plants—the vessels, the leaves, the seeds, &c.

Since the meeting, Mr. Teschemacher has continued his investigations, and has communicated in a letter to one of the editors the following results:—

1st. What I considered as vessels were said to be mere marks of sliding of the coal. Prof. Bailey prepared a specimen of this by his method, and told me that if I found vessels there, my proposition was correct. Examined by Agassiz and myself, with his large Oberhauser, it turns out to be *nothing* but a *mass* of perforated vessels, as clear and distinct as if they were recent. M. Agassiz observed, "One moment suffices to remove every doubt on the subject."

2nd. What I considered as fossil seeds were said to be mere peacock-eye coal; the dark carbonaceous centres of these seeds, which I held to be carbonized cellular matter, was thought to be a mere mistake and the seeds imaginary. I have since discovered them with distinct and clear apparently spinous appendages. M. Agassiz thinks the seed a Samara, and I have found sufficient quantity to pick out the carbonaceous matter from the interior with a fine needle —decarbonize it in a clean platina crucible over a spirit-lamp, with every possible precaution to prevent any foreign substance mixing therewith. On examining this with the Oberhauser, 700 diameters, M. Agassiz showed to Dr. Gould and myself the cells as clear and plain as possible; it is a mass of cellular matter, as I stated. You may of course imagine the extreme tenuity of the parietes of cells of seeds when decarbonized, and the difficulty of those less experienced than M. Agassiz in the microscope in managing the subject—he feels quite convinced of their being fossil seeds. The nature of the genus of plants must require further examination.

3rd. The smooth glossy surfaces, which I considered the external parts of large plants rendered smooth by intense pressure, were said to be nothing more than slickensides. My position here is proved much more easily than in the other cases, by specimens passing gradually from the smoother through different degrees of protuberance (all still smooth and polished), until we arrive at the full form of the Lepidodendron. Nay more, I have found the parallel lines (channels) which are on the slickensides, also on the perfectly-formed Lepidodendra. The correctness of my views here I could prove to the most sceptical.

The discoveries still to be made on this subject are numerous and important; and I doubt not that the investigation of the coal itself will soon solve the doubts hitherto existing in the comparison of the coal fossils with recent plants.

I will merely add, that I have found quite distinctly the impression of the cellular cuticle of some of these plants, which of course cannot be seen in an impression on shale, the grains of the sedimentary matter being as large as the surface of the cells; but on the pasty mass of coal the impression is perfect.—*Silliman's Journal, November* 1847.

A Fact respecting the Habits of Notonecta glauca. By Prof. Forrest Shepherd.

In the evening twilight of a pleasant day in September 1846, Sir George Simpson encamped for the night, on his route from Red River to the head waters of the Mississippi, in the vicinity of latitude 48° north and longitude 95° or 96° west from Greenwich.

While supper was preparing, he perceived something falling on his hat like drops of rain; but as there were no clouds to be seen, presumed it could not be rain. On looking on the ground near the fire he saw distinctly that the falling substance instead of being rain was a small winged insect, which although unable to fly had yet life and motion. The number rapidly increased so as to give great annoyance by falling into the frying-pan and supper vessels, and continued until the ground was covered by the shower. On the following morning Sir George ascertained that this extraordinary shower extended at least from twenty-five to thirty miles in the direction he was travelling. No information has been received as to its extent in other directions. It was observed that soon after the shower the weather changed suddenly from warm to cold. It is therefore probable that the whole of this immense swarm of insects encountered the cold current, and were paralyzed and precipitated thereby. They all died soon after falling. Specimens of these insects were collected by the attendants of Sir George, from whom I received them. In no instance however were they seen to revive after coming into a warmer atmosphere.—*American Journal of Science and Arts for Nov.* 1847.

METEOROLOGICAL OBSERVATIONS FOR DEC. 1847.

Chiswick.—December 1. Very fine: clear. 2. Frosty: overcast and mild. 3. Densely overcast: rain. 4. Clear: overcast: boisterous. 5. Fine. 6. Boisterous, with rain: lightning at night. 7. Rain: cloudy and boisterous: clear and windy at night. 8. Clear and cold. 9. Rain: overcast. 10. Rain: cloudy. 11. Densely clouded: fine. 12—14. Very fine. 15. Very fine: slight rain. 16. Cloudy. 17. Slight rain. 18. Rain. 19. Fine: cloudy. 20. Cloudy. 21—23. Overcast. 24. Foggy. 25, 26. Overcast. 27, 28. Cloudy. 29. Hazy. 30. Rain. 31. Hazy and damp.

Mean temperature of the month	41°·09
Mean temperature of Dec. 1846	31 ·26
Mean temperature of Dec. for the last twenty years	39 ·59
Average amount of rain in Dec.	1·58 inch.

Boston.—Dec. 1. Fine. 2. Fine: 8 o'clock P.M. thermometer 54°. 3. Cloudy: rain P.M. 4. Fine: rain P.M. 5. Cloudy: rain early A.M. 6. Rain. 7. Rain: stormy A.M. and P.M. 8. Fine: rain A.M. 9. Rain. 10. Fine. 11, 12. Cloudy. 13—15. Fine. 16. Rain. 17. Fine: rain early A.M. 18. Rain: rain A.M. and P.M. 19. Fine. 20. Rain. 21. Fine. 22—29. Cloudy. 30. Snow: rain and snow A.M. and P.M. 31. Rain: rain A.M.

Applegarth Manse, Dumfries-shire.—Dec. 1. Wet A.M.: cleared and was fine. 2. Wet A.M.: damp all day. 3. Damp A.M.: cleared: fine. 4. Heavy rain and high wind. 5. Rain: unsettled weather. 6. Shower of snow: frost. 7. Heavy rain: frost A.M. 8. Fair, but cloudy. 9. Rain early A.M.: fine. 10. Showers. 11. Rain all night and morning. 12. Fair and fine. 13. Fair A.M.: rain and wind P.M. 14. Fine A.M.: rain P.M. 15. Mild and fair A.M.: rain P.M. 16. Rain nearly all day: flood. 17. Fair and mild: slight rain P.M. 18. Fair, but cloudy. 19. Frost A.M.: dull and cloudy. 20, 21. Frost, slight. 22. Frost, hard: clear. 23. Fine: slight frost. 24. Fine. 25. Frost: fine and clear. 26. Fine: clear. 27, 28. Frost: fine. 29. Heavy fall of snow. 30. Snow lying: frost, hard. 31. Frost, very keen: thermometer $11\frac{1}{2}$°.

Mean temperature of the month	40°·2
Mean temperature of Dec. 1846	33 ·5
Mean temperature of Dec. for twenty-five years	38 ·19
Mean rain in Dec. for twenty years	2·94 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse*, Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse*, Orkney.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. Dec.	Max.	Min.		9 a.m.	9 p.m.	9¼ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9¼ a.m.	8½ p.m.								
1.	30·353	30·188	29·75	29·87	30·00			51	25	42	47	36½			w.	w.	w.		......	......	......	
2.	30·269	30·173	29·83	29·90	29·80			55	51	42	54	40			sw.	calm	s.		......	......	......	
3.	30·113	29·992	29·60	29·84	29·73			57	36	55	54	45			sw.	calm	sw.		·11	......	......	
4.	29·943	29·445	29·49	29·50	29·00			51	41	40·5	50	42½			sw.	w.	sw.		·28	·12	......	
5.	29·486	28·287	28·88	28·98	29·10			53	31	43	45	36			sw.	w.	wsw.		·12	·50	......	
6.	28·837	28·550	28·42	28·40	28·19			53	40	48	45½	35			sw.	s.	w.		·17	·38	......	
● 7.	29·202	28·611	28·27	28·80	29·10			53	31	42·5	42	35½			nw.	nw.	nw.		·01	·13	......	
8.	29·725	29·528	29·20	29·29	29·36			43	28	33·5	35½	29			w.	w.	wsw.		·16	·04	1·67	
9.	29·707	29·538	29·11	28·98	29·05			57	51	48	51	32			sw.	sw.	sw.		·03	·26	......	
10.	29·835	29·778	29·34	29·50	29·59			55	49	53	52½	42			sw.	s.	w.		·01	·03	......	
11.	29·872	29·730	29·32	29·30	29·49			53	29	51	44	36			sw.	s.	wsw.		......	......	......	
12.	30·018	29·937	29·56	29·60	29·73			53	38	44	47½	42			s.	s.	s.		......	......	......	
13.	30·028	29·992	29·65	29·65	29·74			53	35	41	49½	43			s.	s.	se.		......	......	......	
14.	30·056	30·032	29·69	29·79	29·79			51	32	44	49	42			s.	sse.	se.		......	......	......	
☽ 15.	30·018	29·972	29·65	29·62	29·66			54	47	42·5	50½	42			s.	sse.	ese.		·01	......	......	
16.	29·885	29·806	29·48	29·52	29·45			53	46	48·5	52½	42			s.	s.	ese.		......	·03	1·37	
17.	29·772	29·538	29·37	29·30	29·08			55	46	48·5	53	43			s.	s.	se.		·03	·02	......	
18.	29·462	29·339	29·12	29·19	29·24			49	26	48	54	45			s.	s.	sw.		·34	·29	......	
19.	29·520	29·388	29·13	29·22	29·48			47	32	38	43½	43			se.	se.	nne.		·01	65	......	
20.	29·675	29·667	29·41	29·70	29·69			41	31	39	49	42½			ne.	s.	ne.		......	......	......	
○ 21.	29·619	29·579	29·34	29·59	29·52			35	31	35	39	32½			ne.	e.	ne.		......	......	......	
22.	29·948	29·732	29·47	29·66	29·85			36	31	33·5	36	33½			ne.	e.	se.		......	......	......	
23.	29·910	29·658	29·58	29·74	29·56			39	32	34	38½	33½			e.	calm	se.		·05	......	1·02	
24.	30·045	29·786	29·59	29·85	30·08			40	35	37·5	38½	29			ne.	e.	ne.		......	......	......	
25.	30·185	30·148	29·90	30·10	30·24			41	35	41	42½	35			ne.	ne.	e.		......	......	......	
26.	30·190	30·141	29·90	30·22	30·19			40	30	39	42	37½			ne.	ne.	e.		·01	......	......	
27.	30·225	30·204	29·95	30·18	30·16			37	30	35·5	36	29			nw.	calm	ne.		......	......	......	
28.	30·195	30·182	29·92	30·15	30·10			37	25	36	37½	32			ne.	nnw.	ne.		......	......	......	
☾ 29.	30·094	29·740	29·75	29·78	29·38			38	35	34	35½	32			se.	se.	e.		·17	......	......	
30.	29·856	29·712	29·45	29·64	29·84			40	32	33	38½	33			s.	sse.	n.		·30	......	0·12	
31.	29·854	29·817	29·60	29·83	29·72			37	30	34·5	24½	11½			ne.	se.	e–sw.		......	·61	......	
Mean.	29·867	29·685	29·42	29·570	29·577			47·00	35·19	41·4	44·4	36·5							1·81	3·06	4·18	

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XVI.—*Further Observations on the* Diatomaceæ; *with descriptions of new genera and species.* By G. H. K. Thwaites, Lecturer on Botany and Vegetable Physiology at the Bristol Medical School.

[With two Plates.]

Agreeably with the promise made in my last communication, I proceed to offer a few observations upon the facts there brought forward with reference to conjugation in the *Diatomaceæ*, and especially as to the bearing which these facts have upon the subject of impregnation in the higher tribes of plants.

It may be desirable perhaps, by way of preliminary, to give a short general account of the phænomena, as far as they have been observed, which present themselves in the course of development of a species of the *Diatomaceæ*.

The frustules of a Diatomaceous plant, which are usually, as is well known, of very definite and often very beautiful figure, are continually undergoing fissiparous division—that is, the contained endochrome of each one of these frustules divides into two portions, each of which developes around itself a cell-wall possessing a form and character precisely similar to those of the original one. The process of fissiparous division continuing, necessarily in course of time causes a very considerable increase in the number of frustules. There appears however to be a limit to this mode of propagation of the frustules, except by the intervention of another phænomenon—namely conjugation, or a mixture of endochromes; after which process fissiparous division proceeds as before.

It seems probable that *physiologically* we ought to consider the numerous frustules which have originated from the primordial frustule (the sporangium or product of conjugation) not as so many individuals of a species, but rather as parts of one individual, which instead of, as takes place in the higher plants, cohering to form one structure, assuming forms more or less modified, and exhibiting a greater or less specialization of func-

tion, maintain an independent existence (analogous to that of the buds of the higher plant), retain all the functions necessary for this independent life and for the propagation of the species, and undergo no modification from their original form. The life of an individual Diatomaceous plant we may therefore consider to extend from the production of the sporangium to the period of the conjugation of the numerous frustules which have originated from it.

Now, for the sake of comparison, let us analyse the higher plant: we find it to consist but of a repetition of similar parts and structure; and by carrying the analysis still further we ascertain the whole to be a modification of cellular structure, and that this cellular structure is the product of a continued fissiparous division commencing from the contents of the primordial cell—the earliest condition of the embryo. In fact, that the entire active vital part of the whole plant is but a diffusion, as it were, of the contents (the endochrome) of the primordial cell. This endochrome possesses an individuality—a character—which though not appreciable by our senses, would be found, were it in our power to analyse it, to be as defined as when, in its further development, it has assumed all the marked peculiarities of the species. The complicated development of the higher plant may be said to be the expression of the quality of the endochrome of its primordial cell, just as the simple development of the frustule of the Diatomaceous plant expresses the quality of its endochrome. If the foregoing is a correct view of the matter, it follows that the sporangium of the Diatomaceous plant is the analogue of the primordial* cell of the flowering plant.

We may now proceed more particularly to the subject of conjugation. In many of the *Diatomaceæ* it is seen that at a certain period of the development of the species a union of the endochromes of two distinct frustules seems necessary for the continued existence of the species as well as for its reproduction. The physiologist will endeavour to arrive at some probable explanation of the reason why this mixture of endochromes is necessary, and he will feel it difficult to come to any other conclusion than this: namely, that in each of the conjugating endochromes an essential element must to some extent, probably very trifling, be wanting, whilst another essential element is in excess, and that a mixture of such an endochrome with another similarly conditioned, except that the quantities of such respective elements are reversed, must take place in order to restore the equilibrium and enable the species to continue its existence. The circumstance of the mixed endochrome developing around itself a cell-wall pre-

* This must not be confounded with the "primordial utricle" of Mohl.

cisely similar in every respect, except in size, to that of the ordinary frustule, would seem to indicate very slight, if any, difference in the qualities of their respective endochromes. The *sporangium*—the product of this mixed endochrome—undergoes fissiparous division too in like manner with the ordinary frustules, and is thus converted into a number of *sporangial frustules*. In what way the small ordinary frustules are produced from these has not yet been observed.

Why should not this conjugation of the endochrome in the lower plants be considered essentially the same process as what takes place during impregnation in the higher tribes? The most eminent physiologists seem to be arriving at the opinion that the fertilization of the ovule, as it is termed, consists in the union of a part of the contents of a pollen-grain with certain matter contained in the ovule, and that the embryo originates from this mixed matter. The correctness of this opinion is rendered still more probable by the consideration of what takes place under the circumstances of hybridization of species. The phænomena which present themselves in these cases are of the highest physiological interest, and it seems impossible after a careful consideration of them to doubt that the hybrid plant owes its existence to—consists in its earliest condition of—an endochrome made up of a portion of the endochrome of each of the parent plants; for the development of the hybrid embryo into the mature plant indicates a quality of the contents of this embryonic cell of a character combining that of the endochrome of each of the two parents. A few facts will best illustrate the meaning of the foregoing observations. The ovules of *Fuchsia coccinea* fertilized with the pollen of *Fuchsia fulgens* produce plants of every intermediate form between these two species—some of the seedling plants closely resembling one, and others the other species, but the majority partaking equally of the characters of the two parents: scarcely however will any two be found so much alike as to be undistinguishable from each other. With respect to each of the hybrid seedlings separately considered, there is a uniformity throughout in the mixed character of its various parts; so that it is easy from the examination of the foliage to arrive at a tolerably correct idea of what will be the character of the blossom. Some persons perhaps will be disposed to believe that an endochrome may be modified in its character—that the peculiarities of the hybrid plant may be produced—by the situation in which it is at first developed; but, if this were the fact, it is clear that the hybrid seedlings ought all to resemble each other as much as do individuals of one species, which is far from the truth, as has been just now stated. Moreover, a fact came under the observation of the writer which completely sets aside the

idea of such an explanation of the phænomena, for in one example of the hybrid *Fuchsia* seedlings the singular circumstance occurred of one seed producing two plants extremely different in appearance and character; one of them partaking rather of the character of *Fuchsia fulgens* and the other of *Fuchsia coccinea*. It cannot be doubted that these very dissimilar structures were the produce of one seed, since they were closely coherent, below the two pairs of cotyledon leaves, into a single cylindrical stem, so that they had subsequently the appearance of being branches of one trunk. The plant was unfortunately, before flowering, killed by an unexpected severe frost, but not before its peculiarity had been observed by many persons besides the writer. In the case just cited the idea of a modification of structure caused by mere circumstance of situation in the early stage of growth is quite untenable; for were such the case, it is clear there could not have been the great dissimilarity which presented itself in these twin-plants—the produce of a single seed.

The following explanation of the phænomena of hybridization appears to the author to be most probably the correct one; namely, that the hybrid embryo consists, like an ordinary embryo, of a mixture of two endochromes—one derived from the pollen-grain and the other from the ovule; and that the peculiar character of each hybrid individual is due to the preponderance of one or other of these endochromes. This view of the matter seems to remove much of the mystery which at present surrounds this subject.

Returning again to the consideration of the lower plants. It is true that in the *Diatomaceæ*, as far as has been yet observed, there is no appearance of a difference of sex—there is nothing to indicate a diversity in the character of two conjugating frustules. In an allied family, however, the *Conjugateæ*, there is, as Mr. Jenner pointed out to me some months ago, an apparent adumbration of the sexes. The filaments of the genus *Zygnema* consist each of a single row of cells which correspond to the frustules of the *Diatomaceæ*, like them undergoing fissiparous division and becoming conjugated. Conjugation of the cells of *Zygnema* however takes place by the endochrome of one cell finding its way into another cell and there mixing with its endochrome; so that the sporangium is formed in one of the cells instead of outside both cells, as in the *Diatomaceæ*. In several species of *Zygnema* some of the filaments consist of cells, all of which, with the rarest exception, after conjugation contain the sporangia, whilst all the cells of other filaments of the same plant are seen to have entirely parted with their endochrome. This has much of the aspect of sexuality, and the sight of the conjugated filaments suggests at once this idea to the mind.

The conjugation of the *Diatomaceæ* seems to throw some light upon a question of much interest with respect to the real nature of certain vegetable structures, respecting which many eminent botanists are at present at issue. The structures alluded to are the so-called *antheridia* and *pistillidia* (archegonia) of Mosses. The paper on this subject by Mr. Valentine* would seem to settle the point that there can be no impregnation of the contents of the moss-capsule by the introduction into its cavity of any external substance, after the formation of the sporules. On the other hand, the learned authors of the 'Bryologia Europæa' state with emphasis that certain species of Mosses, which are dioicous,—that is, some plants of the same species bearing *antheridia* only, and others only *archegonia*,—do not bear fruit unless the male plants (those with antheridia) are in the neighbourhood of the plants possessing archegonia. It is perhaps not impossible to reconcile these at first sight apparently conflicting opinions. It may be that impregnation takes place before the production of the capsule;—that the cell from which the capsule, with its seta, &c. is developed corresponds with the sporangium of the Diatomaceous plant or the embryonic cell of the flowering plant; that this cell contains a mixed endochrome derived partly from the antheridia; and that the entire capsule (with its contents, appendages, &c.), the further development of this primordial cell, corresponds to a perfect seed of the flowering plant, or to the aggregate of the sporangial frustules of a Diatomaceous plant. It is true that in some of the Mosses the structure of the capsule appears very complicated, but it is upon a very simple type, as shown in other species: and, moreover, the sporangial frustules of the Diatomaceous plant possess cell-walls as highly developed as occurs in any other phase of the species. In some of the *Conjugateæ* there is also a division of the reproductive mass before this escapes from the plant, so that the numerous sporules of the Moss furnish no argument against the hypothesis just advanced. As a further argument in favour of the idea of the capsule of the Moss being the product of a mixed endochrome, it is stated by Bruch and Schimper that the capsule itself is not developed unless the two so-called sexes of the species are in proximity.

There now remains to consider a tribe of the *Diatomaceæ*, namely the *Meloseireæ*, which would at first seem to offer an exception to the usual mode of reproduction in this family, but the exception is probably rather apparent than real. In those species of *Meloseira* and its allied genera which have been met with in fruit, there is no *evident* conjugation or mixture of endo-

* Linn. Trans. vol. xvii. p. 465–481.

chromes; but it is, nevertheless, perfectly certain that something analogous to it must take place; for, excepting the mixture of the endochromes of two cells, the phænomena here exhibited are of precisely similar character to what has been noticed in the other *Diatomaceæ*. In the *Meloseireæ**, instead of a conjugation occurring between two frustules, a change is observed to take place in the endochrome of a single frustule—that is, a disturbance of its previous arrangement, a moving towards the centre of the frustule, and a rapid increase in its quantity: subsequently to this it becomes a sporangium, and out of this are developed sporangial frustules as in the other *Diatomaceæ*. A careful consideration of these phænomena, coupled with the fact of conjugation of endochromes being necessary in other species of the same natural family, leads to the opinion that there is great probability of a process taking place in the one cell of the *Meloseireæ* precisely similar in physiological character to the conjugation or mixture of endochromes in other species. In some species of *Zygnema*, to which genus reference has been before made, a conjugation takes place between *contiguous cells* in the *same filament*, and the contents of such pair of conjugated cells necessarily occupied one cell previously to its fissiparous division: it is therefore not difficult to believe, taking into view the secondary character of cell-membrane, that the two kinds of endochrome may be developed at the opposite ends of one frustule as easily as in two contiguous frustules, and that at a certain period a mixture of these may take place, giving rise to the same phænomena which succeed conjugation in other *Diatomaceæ*. The unity of plan which runs through the whole of nature forbids our entertaining the idea of a physiological, though there may be a structural, difference in the phænomena of reproduction in such closely allied productions as the several species of *Diatomaceæ*.

It is unnecessary to enlarge upon the importance of the doctrines now enunciated, if they are, as I believe, correct; but the remainder of the paper will be more exclusively occupied with observations on the genera and species to be described.

The general mode of formation of the sporangia in the *Meloseireæ* having already been adverted to, it will now be necessary only to indicate the peculiarities exhibited in those species of this family, which have been met with in the state of fructifica-

* It would seem that in the *Biddulphieæ* there is the same absence of an evident conjugation; for specimens of *Odontella polymorpha*, Kütz. (*Biddulphia? lævis*, Ehr. and Bailey), kindly communicated to me by Professor Harvey of Dublin, who received them from Professor Bailey, exhibit sporangia, each evidently originating from the endochrome of a single cell, and in the early stage of growth appearing as a dilatation of one end of such cell.

tion; and it is interesting to find that differences are observable in the character and position of the sporangia sufficient to justify a removal of some of the species from the genus *Meloseira,* in which they are at present included by Professor Kützing in his valuable work on the *Diatomaceæ.* A careful examination shows too, that, independently of the difference in the sporangia, there is sufficient distinction between the frustules themselves to characterize the proposed new genera.

Although it is very probable that hereafter it will be found desirable to break up still further the genus *Meloseira,* it is proposed at present only to separate from it—1st. Those species characterized by the absence in the frustule of an evident central line indicating the place of subsequent fissiparous division, but each frustule having two somewhat distant sulci or fossulæ passing round it—*Aulacoseira.* 2ndly. Those species, the frustules of which are not at all convex at the extremities, and which therefore form by their close contact an uninterrupted cylindrical filament; each frustule is marked with a central line and its internal cavity is spherical or subspherical—*Orthoseira.*

These two new genera may be defined as follows:—

Aulacoseira.—Cellulis cylindricis bisulcatis extremitatibus plus minusve rotundatis in filamenta concatenatis.

Typ. spec. *Meloseira crenulata,* Kütz. = *M. orichalcea,* Ralfs.

Orthoseira.—Cellulis exacte cylindricis linea centrali notatis in filamenta cylindrica connexis; cavitatibus internis sphæricis vel subsphæricis.

Typ. spec. *Meloseira americana,* Kütz.

The genus *Meloseira,* as it stands after this removal of some of its species, will include all those whose frustules are in any degree convex at their extremities, and have the central line indicating the place of future fissiparous division. It will probably be found expedient to separate *Meloseira arenaria,* Moore, from its present congeners when its sporangia have been discovered.

Sporangia or sporangial frustules have been observed by the writer in the following species of the genus *Meloseira* as now restricted, viz. in *M. varians,* Ag., *M. nummuloides,* Ag., *M. Borreri,* Grev., and in an Antarctic species collected by Dr. Hooker allied to *M. globifera,* Ralfs. In these species the sporangium is spherical with its axis of growth corresponding with that of the filament in which it is situated, and to which it continues for some time closely to adhere. The sporangium of *M. varians,* Ag., has one, sometimes two projections or mammillæ, each of which fits into an empty half-frustule, and frequently so closely as to be inseparable from it. Pl. XI. fig. A 1 represents various forms and stages of development of the sporangium of *M. varians*; and

fig. A 2 a filament consisting of sporangial frustules produced from one sporangium. Fig. C is a filament of *M. Borreri*, consisting partly of ordinary and partly of sporangial frustules. *M. nummuloides* of Kützing I cannot help believing to be the sporangial state of *M. salina* of the same author.

In *Aulacoseira crenulata* the sporangium is spherical, with its axis of elongation at right angles to that of the frustule from which it originated. Around the young sporangium a considerable quantity of mucus is developed, by which the empty half-frustules are for some time held attached. Fig. B 2 represents filaments of *Aulacoseira crenulata* with sporangia; and fig. B 3 sporangial frustules of the same species.

Orthoseira Dickieii, n. sp. Pl. XII. fig. E 1–7 ($\frac{220}{1}$). Filamentis brevibus; cellulis lævissimis.

The filaments of this beautiful species consist generally each of from two to four frustules, which are hyaline and perfectly smooth, and each with its central cavity filled with a dark red-brown endochrome. The sporangium of *Orthoseira Dickieii* is no less beautiful than interesting: it is fusiform in shape and marked with numerous annular constrictions, each with a corresponding internal septum or chamber, the origin of which can only be understood by paying attention to the early development of the sporangium. In fig. E 3 is shown a filament of this species, the terminal cells of which have each commenced to develope a sporangium; E 4 represents two such cells or young sporangia; and E 5 a mature sporangium. It will be observed that the formation of the ring-like markings is progressive, and that they go on increasing in number until the sporangium is fully developed. At the commencement of the formation of the sporangium, the endochrome, at the same time that it withdraws from the end of the frustule, produces at its centre an additional ring of cell-membrane; and this process continuing to take place at certain intervals—each new ring of cell-membrane exceeding in diameter those previously formed—produces at length the structure represented in E 5. Or it may be a more correct explanation of the process to say, that an entire new cell-membrane has been developed by the young sporangium at the time each new ring has been formed, and that thus have originated the several chambers into which the ends of the sporangium are divided. Fissiparous division of the sporangium subsequently takes place, as shown in fig. E 6, and sporangial frustules are developed from each half, E 7.

Meloseira americana, Kütz. Bacillarien, 55. tab. 30. fig. 69, is evidently congeneric with this species; differing from it principally in the ends of its frustules being striated.

Orthoseira Dickieii was kindly communicated to me by Dr. Dickie, who discovered this beautiful species in December last near Aberdeen in a moist dripping dark cave close by the sea, and covering the Mosses, Hepaticæ, &c. as a fine blackish green sand, collecting also in the shelvings of the rock.

Cyclotella? Kützingiana, n. sp. Pl. XI. fig. D 1–5 ($\frac{22}{1}$). Cellulis latere primario sigmoideo-flexuoso, lateribus secundariis radiatim striatis.

The frustules of this species, fig. D 1, 2, are short, and exhibit an apparent sigmoid curvature, which is due to each of their striated disciform ends having a prominence on one side of its centre and a depression on the other, and the opposite end of the frustule having a depression and prominence corresponding to these. The sporangia, fig. D 3, 4, are developed much in the same way as in *Meloseira*. This species is evidently closely allied to *Cyclotella? minutula*, Kütz. Bacill. tab. 2. fig. 3, but differs in the fewer number of curvatures apparent in the frustule. The sporangial frustules, fig. D 5, are very similar to *Cyclotella? Rotula*, Kütz. Bacill. tab. 2. fig. 4. A species of *Cyclotella* collected by Geo. Dansey, Esq. near Devonport, and which I suspect may be the *C. operculata* of Kützing, differs from the present species in the radiating striæ being only slightly marked, and in the curved appearance of the frustule being scarcely evident.

Occurs in brackish ditches amongst the leaves of *Myriophyllum*, &c. Wareham, Rev. W. Smith; Shirehampton near Bristol, G. H. K. T.

Before taking leave for the present of the *Meloseireæ*, I cannot avoid referring to the analogy they offer to the genus *Tiresias*, Bory (*Œdogonium*, Link, *Vesiculifera*, Hassall), and its allies. The *Meloseireæ* seem to bear the same relation to these that the other *Diatomaceæ* do to the *Conjugateæ*. The annulated structure of the sporangium of *Orthoseira* also recalls to mind and explains the character of the rings which are met with at the end of the fructifying cell in *Tiresias*.

Schizonema eximium, n. sp. Pl. XII. fig. F 1 ($\frac{1}{1}$), 2, 3, 4 ($\frac{220}{1}$). Cœlomatibus simplicibus aut parce ramosis, rugulosis: naviculis sigmoideis lævibus.

The sigmoid frustules of this beautiful freshwater species at once distinguish it from any other described *Schizonema*. The delicate gelatinous sheaths are simple or very sparingly branched and minutely rugulose, especially near their base; they contain from one to four rows of the large, smooth, sigmoid frustules.

Found in small quantity in a rapid stream of fresh water on the filaments of *Vaucheria*, roots of grass, &c., at Crew's Hole near Bristol, in December last.

Schizonema subcohærens, n. sp. Pl. XII. fig. G 1 ($\frac{1}{1}$), 2 ($\frac{20}{1}$), 3–7 ($\frac{220}{1}$). Cælomatibus in massam amorpham subcohærentibus, valde mucosis, ramosis, navicularum sæpe multas singulas series continentibus: naviculis late truncatis, versus apices subito angustatis, striatis.

Evidently closely allied to *Schizonema* ? *mucosum*, Kütz. Bacill. 115. tab. 26. fig. 9, but differs from it in having the frustules striated and towards the apices suddenly narrowed. Tufts of the plant from a quarter to half an inch or more high; filaments very mucous and tenacious, and each containing from one to several single rows of frustules, which are continued without interruption into the branches.

For the opportunity of figuring and describing this interesting species I am indebted to the kindness of the Rev. W. Smith, F.L.S., who found it in June last in Wareham "North River," densely spreading in a spongy stratum over the clayey bank and bottom of the stream.

The sporangia of this species, fig. G 6, are produced by the conjugation of a pair of frustules outside the filaments; but sporangial frustules are frequently found in a filament intermixed with ordinary frustules, from which they differ only in size: from this and from what has been observed by the writer in other species, it would appear that the frustules have a tendency to arrange themselves into linear series, and that subsequently a mucous sheath is developed around them.

Schizonema subcohærens would appear to belong to Agardh's genus "*Micromega*": it is difficult however to see the advantage of creating a new genus from characters derived from the mucous sheath only, and which characters really may be present in some species without being clearly evident. The so-called "*spermatia*" of *Micromega*, now that the true sporangia have been discovered, require further examination: a somewhat similar appearance to what is figured by Kützing is sometimes evidently due to minute zoophytes in an immature state.

Schizonema vulgare, n. sp. Pl. XII. fig. H 1 ($\frac{1}{1}$), 2–5 ($\frac{220}{1}$). Naviculis lævibus, lanceolatis, versus apices subito angustatis. *Hab.* in aqua dulci.

Var. *α. rivulorum.* Fig. H 1–4. Cælomatibus distinctis, ramosis: naviculis subacutis.

Var. *β. lacustre.* Fig. H 5. Cælomatibus mucosis, simplicibus (aut parce ramosis?): naviculis latius truncatis quam in varietate præcedenti.

Monema lacustre, Agardh?

Var. *γ. effusum.* Cælomatibus indistinctis, in stratum gelatino sum effusis: naviculis ut in varietate *α.*

Although this is perhaps the commonest species of all the *Schizonemata,* since it occurs during the spring in almost every ditch and running stream, yet it does not appear hitherto to have been described, unless the *Monema lacustre* of Agardh should prove to be one of its forms. The species is most abundant in shallow streams, covering stones, &c. with a dark brown gelatinous coating, but in which a linear arrangement of the frustules may frequently be detected. When the plant occurs in deeper water, the ordinary *Schizonema* filaments make their appearance, which are much-branched when growing in rapid streams, but when occurring in still water, or where there is only a slight current, are simple or nearly so. In the last-named form of the species, which may possibly be the *Monema lacustre,* Ag., there is also a slight difference in the form of the frustules, which are rather shorter compared with their width, and more truncated at their extremities. The frustules of all three varieties are of a lanceolate form, suddenly narrowed near the apices.

Schizonema neglectum, n. sp. Pl. XII. fig. J 1 ($\frac{1}{1}$), 2–4 ($\frac{220}{1}$). Cælomatibus ramosis, mucosis: naviculis lanceolatis, delicatule striatis.

The filaments of this species, which are branched, especially towards the base, easily escape detection owing to particles of sand and other substances adhering to their tenacious surface and being with difficulty removed from it. It is therefore next to impossible to get good examples of this species, and hence the reason why it has hitherto escaped the observation of botanists. The frustules are lanceolate and very delicately striated, and are very like those of *Schizonema floccosum,* Kütz., which has been found by Dr. Dickie near Aberdeen; but in that species they are not striated, and are moreover included in a gelatinous sheath of much greater thickness than that of *Schizonema neglectum.*

Occurring amongst other *Diatomaceæ* from fresh or slightly brackish water near Bristol.

Dickieia Danseii, n. sp. Pl. XII. fig. K 1 ($\frac{30}{1}$), 2–4 ($\frac{220}{1}$). Frons gelatinosa, indefinita, mammillosa: naviculis ovalibus, striatis.

The frustules of this species are siliceous and of an oval form,

with a linear space on either side of the central mark striated. This beautiful new species is extremely interesting as illustrating the real structure of the genus *Dickieia*. Each frustule developes around itself a definite amount of gelatine, so that at each repetition of fissiparous division additions are made to the amount of gelatine of the frond by the new frustules which are then produced. In the present species these additions are in the form of mammillæ, and a good deal resemble the mucous prolongations of some of the *Palmelleæ,* a frustule being situated towards the extremity of each. A mammillose and somewhat areolate appearance is thus given to the indefinite frond, whereas in *Dickieia ulvoides* the newly developed additions to the gelatine cohere to form a compact even membrane.

I have great pleasure in naming this species in compliment to its discoverer George Dansey, Esq. of Devonport, who finds it in small quantity upon rocks on the tidal shore of the river Tamar.

EXPLANATION OF PLATES XI. AND XII.

PLATE XI.

A. *Meloseira varians,* Ag. 1. Filaments with sporangia. 2. Filament consisting entirely of sporangial frustules. (Magnified 220 linear.)

B. *Aulacoseira crenulata.* 1. Filament. 2. Filaments with sporangia. 3. Sporangial frustules. (Magnified 220 linear.)

C. *Meloseira Borreri,* Grev. Filament consisting partly of ordinary and partly of sporangial frustules. (Magnified 220 linear.)

D. *Cyclotella? Kützingiana.* 1, 2. Frustules. 3. Frustules becoming converted into sporangia. 4. Sporangia. 5. Sporangial frustules. (220 linear.)

PLATE XII.

E. *Orthoseira Dickieii.* 1, 1. Filaments. 2. Filament deprived of endochrome. 3. Filament the terminal cells of which are becoming converted into sporangia. 4. Immature sporangia. 5. Sporangium. 6. Sporangium become fissiparously divided. 7. Sporangial frustules becoming developed from one of the halves of a sporangium. (Magnified 220 linear.)

F. *Schizonema eximium.* 1. Filaments (nat. size). 2. Portion of filament (magnified 220 linear). 3. Frustule. 4. Frustule deprived of its endochrome.

G. *Schizonema subcohærens.* 1. Portion of plant (nat. size). 2. Part of same (magnified 20 linear). 3. Part of filament (magnified 220 linear). 4. Frustule. 5. Frustule without endochrome. 6. Sporangia. 7. Sporangial frustule.

H. *Schizonema vulgare.* 1. Filaments of var. *a.* (nat. size). 2. Filament (magnified 220 linear). 3. Frustule. 4. Frustule without endochrome. 5. The same (of var. *β.*).

J. *Schizonema neglectum.* 1. Filaments (nat. size). 2. Filament (magnified 220 linear). 3. Frustule. 4. Frustule deprived of its endochrome.

K. *Dickieia Danseii.* 1. Portion of frond (magnified 35 linear). 2. Part of same (magnified 220 linear). 3. Frustule. 4. Frustule without endochrome.

XVII.—*Researches having for their object the Elucidation of certain Phænomena in the Physiology of the* Araneidea. By John Blackwall, F.L.S.

Since an epitome of my researches into the structure, functions and œconomy of the *Araneidea* was published in the 'Report of the Fourteenth Meeting of the British Association for the Advancement of Science, held at York in September 1844,' and in the fifteenth volume of the 'Annals and Magazine of Natural History,' I have repeated, with slight modifications, several of the experiments relative to the reproduction of the limbs of spiders therein detailed, and as they appear to present some interesting results I shall give them in the order of their occurrence, together with the inferences deduced from them.

1. The digital joint of the left palpus of an immature female *Tegenaria civilis* was amputated on the 28th of April 1845. On the 24th of the following June the spider cast its integument and the left palpus was reproduced; it was unsymmetrical in form, the axillary, humeral and cubital joints being equal in size to the corresponding parts of the right palpus, but the radial and digital joints were small. The digital joint of the new palpus was amputated on the 28th of June, and the limb was again restored at the succeeding moult, which took place on the 18th of August in the same year, when the radial and digital joints, though enlarged, were still inferior in size to those of the right palpus.

2. A very young female *Tegenaria civilis* had the right posterior leg detached at the coxa on the 30th of April 1845 by means of a fine pair of forceps. It moulted on the 19th of June, when the right posterior leg, of a small size, was reproduced. On the 26th of the same month the new leg was detached at the coxa, and was reproduced on the 30th of July, when the spider again cast its integument. This leg was detached in like manner on the 5th of August, and was reproduced on the 11th of September, at which period also the spider moulted. On the 14th of September the leg last restored was detached, and was reproduced on the 8th of November, when the spider underwent its final moult and arrived at maturity. The right posterior leg, which was reproduced four times, maintained its symmetry inviolate through the whole of these changes; but though its dimensions were enlarged with the growth of the spider at each successive change of integument, yet they were always greatly inferior to those of the corresponding leg on the opposite side.

3. On the 28th of June 1845 a very young female *Tegenaria civilis* had the right anterior leg detached at the coxa. It moulted on the 6th of July, but the coxa only of the mutilated leg was

produced. On the 8th of August it moulted again and the entire limb was restored. The same leg was detached at the coxa on the 14th of August, the 26th of September, and the 12th of November; and was reproduced on the 19th of September, the 8th of November, and the 20th of May 1846, respectively, at which periods the spider changed its integument. At the last date, the right palpus, which had been detached at the axillary joint on the 12th of November 1845, was also reproduced; both it and the right anterior leg were small but symmetrical, the latter having been reproduced four times.

4. A very young male *Tegenaria civilis* had the left posterior leg detached at the coxa on the 5th of August, the 14th of September, and the 29th of October 1845, and on the 18th of April and the 8th of June 1846. This spider cast its integument on the 10th of September and the 25th of October 1845, and on the 10th of April, the 5th of June and the 4th of July 1846, respectively, at each of which dates, except the last, the left posterior leg was reproduced, but on the 4th of July the coxa only was produced. The circumstances attending the restoration of this limb were similar to those recorded in experiments 2 and 3. I may add, that the spider frequently moistened the tarsus of the third leg on the left side with saliva and applied it to the injured part.

5. Half of the metatarsus, with the tarsus, of the right anterior leg of an immature male *Epëira antriada* was amputated on the 20th of August 1845. On the 8th of the ensuing September the spider moulted and the right anterior leg was reproduced. The coxa, femur and tibia of the new limb were of the same dimensions as those parts of the corresponding leg on the opposite side, but the metatarsus and tarsus were very small.

6. An immature female *Ciniflo ferox* had about a third of the tibia, the metatarsus and tarsus of the left anterior leg amputated on the 14th of March 1846. It moulted on the 14th of the following May, when the coxa, femur and genual joint of the left anterior leg, which was reproduced, were of the same size as the corresponding parts of the right anterior leg, but the tibia, metatarsus and tarsus were very diminutive. This spider moulted again on the 23rd of July in the same year; at the same time the tibia, metatarsus and tarsus of the new limb were considerably enlarged.

7. A young female *Tegenaria civilis*, which had the right posterior leg amputated near the anterior extremity of the tibia on the 16th of March 1846, cast its integument on the 24th of the ensuing May and the mutilated limb was reproduced; the coxa, femur and genual joint were of the same dimensions as the cor-

responding parts of the left posterior leg, but the tibia, metatarsus and tarsus were small.

8. The left posterior leg of an immature female *Tegenaria civilis* was amputated near the anterior extremity of the tibia on the 16th of March 1846. On the 30th of the following May the spider cast its integument and the mutilated limb was reproduced; the coxa, femur and genual joint were of the same size as the corresponding parts of the right posterior leg, but the tibia, metatarsus and tarsus were small. This spider moulted again on the 27th of June in the same year, when a considerable enlargement of the tibia, metatarsus and tarsus of the new limb took place.

9. A very young female *Tegenaria civilis* had the left posterior leg detached at the coxa on the 14th of September 1846. It moulted on the 23rd of the same month, but the mutilated leg was not reproduced till a subsequent moult, which took place on the 4th of May 1847. The same leg was detached at the coxa on the 13th of May, the 24th of June, the 22nd of July, the 30th of August, and the 13th of October; and the spider changed its integument on the 16th of June, the 16th of July, the 22nd of August, the 6th of October, and the 24th of November 1847, respectively, at which periods the left posterior leg was reproduced. Though this limb was restored six times, and was enlarged at each successive moult the spider underwent, yet it constantly retained a symmetrical figure, and through all its changes was greatly inferior in size to the corresponding leg on the opposite side.

10. On the 3rd of June 1847 the left posterior leg of an immature female *Tegenaria civilis* was detached at the coxa, and the right posterior leg was amputated near the middle of the tibia. This spider moulted on the 9th of the ensuing July, at which time the left posterior leg, of small dimensions, but symmetrical in form, was reproduced; the right posterior leg was also reproduced, but the tibia, metatarsus and tarsus, compared with the other joints of the same limb, were greatly disproportionate in size.

11. An immature male *Agelena labyrinthica* had the left posterior leg amputated near the anterior extremity of the metatarsus on the 4th of June 1847. It cast its integument on the 30th of the same month, when the left posterior leg was reproduced. The coxa, femur and tibia were of the same size as the correspondiug parts of the right posterior leg, but the metatarsus and tarsus were small, the latter remarkably so.

12. The left posterior leg of a young female *Agelena labyrinthica* was detached at the coxa, and the right posterior leg was amputated near the middle of the metatarsus on the 5th of June

1847. The spider moulted on the 14th of the same month, when the stumps only of the mutilated limbs were produced. On the 7th of the following July it moulted again, at which time the left posterior leg, of small dimensions, but symmetrical in form, was restored; the right posterior leg was also restored, but the metatarsus and tarsus were disproportionately small.

13. On the 14th of June 1847 the right posterior leg of an immature female *Agelena labyrinthica* was amputated near the middle of the metatarsus. The spider cast its integument on the 2nd of the ensuing July, when the mutilated limb was reproduced. The coxa, femur and tibia were equal in size to the corresponding parts of the left posterior leg, but the metatarsus was very small, and the tarsus was extremely diminutive.

Experiments 2, 3, 4 and 9 serve to establish the fact, that if a leg of an immature *Tegenaria civilis* be detached at the coxa four or even six times consecutively, it may be reproduced at each succeeding moult the spider undergoes. This frequent renewal of the same part seems to warrant the conclusion that a reproduction of the limbs of the *Araneidea* generally, irrespective of mutilation, actually occurs whenever a change of integument takes place; and this view of the subject, which probably might be extended to numerous subdivisions of the Articulata, derives additional support from evidence supplied by the other experiments.

That the dimensions of reproduced limbs are in inverse ratio to the extent of the injury previously inflicted on the parts is manifest from experiments 1, 3, 10 and 12; thus, palpi and legs detached at the axillary joint and coxa are usually symmetrical, but diminutive, when reproduced; while those amputated at the articulation of the digital with the radial joint, and near the middle of the tibia or the metatarsus, on being restored are always very much larger and unsymmetrical; in point of fact, the development of the new limb depends upon the capacity of the undetached portion of the mutilated part; for if a leg be amputated near the middle of the metatarsus, as was the case in experiments 5, 12 and 13, the coxa, femur and tibia will be of the same dimensions as those joints of the corresponding leg on the opposite side, but the metatarsus and tarsus will be very diminutive; should the excision be made near the anterior extremity of the tibia, as in experiments 6, 7 and 8, then the size of the coxa, femur and genual joint will be normal, but that of the tibia, metatarsus and tarsus will be very abnormal. These curious results plainly demonstrate, that not only reproduced limbs in their totality, but that particular joints also are limited in their dimensions by the capacity of the undetached portion of the mutilated part in which they are developed, and that restored legs and

palpi are never symmetrical except when developed in the undetached coxa and axillary joint respectively.

In order to obtain a satisfactory explanation of the phænomena stated above, it must be conceded that the limbs of spiders produced at each successive moult, from the period at which the animals quit the cocoon till they arrive at maturity, are absolutely new organs resulting from the vital functions of assimilation and accretion; indeed, the renewal of a repeatedly detached leg at each succeeding change of integument, and the circumstance of the dimensions of entire limbs or portions of limbs depending upon the space allowed for their development at the time of restoration, present difficulties which do not admit of a solution on any other physiological principle that I am aware of.

Sometimes the stump only of a partially amputated leg is produced at the succeeding moult, especially when the injury has been inflicted but a short time previously to the change of integument, as may be seen on referring to experiments 3, 9 and 12. As the formative process in this case must have made considerable progress before the excision of the part was effected, there is nothing extraordinary in the result; but a similar consequence occasionally ensues when the partial amputation of a leg takes place very soon after a change of integument, before the formative process can be supposed to have commenced; experiment 4 presents an instance of this kind; a much more remarkable one, however, is given in the 'Annals and Magazine of Natural History,' vol. xv. p. 233, experiment 12, from which it appears that the stumps only of the palpi of a young male *Linyphia cauta* were produced at two consecutive moults after the parts had suffered mutilation, though several legs of the spider, mutilated at the same time, were renewed at the next moult after the infliction of the injury.

If these facts are inexplicable at present upon the principle of the reproduction of lost parts by the *Araneidea* which I have been advocating, it may be attributed to the obscurity in which they are involved, and as they are decidedly opposed to every other view of the subject, it is not necessary to notice them more particularly in this place.

I avail myself of the opportunity afforded by this communication to correct a statement contained in the epitome of my researches into the structure, functions and œconomy of the *Araneidea*, (Report of the Fourteenth Meeting of the British Association for the Advancement of Science, held at York in September 1844, p. 73; and the Annals and Magazine of Natural History, vol. xv. p. 234,) to the effect, that if part only of a limb of a spider be amputated, as the tarsus of a leg or the digital joint of a palpus, all the joints of the limb when reproduced,

though small, will be proportionate to those of the corresponding limb on the opposite side; whereas it is evident from the preceding experiments that legs and palpi restored after mutilation are never symmetrical except when respectively developed in the undetached coxa and axillary joint alone.

So little appears to have been done for the purpose of determining the longevity of spiders with some approach to accuracy, that a few observations on the subject probably will not be regarded as superfluous.

A young female *Tegenaria civilis*, disengaged from the egg on the 6th of July 1842, after quitting the cocoon was placed in a separate phial and was abundantly supplied with nutriment. It continued in excellent health and condition apparently till the 8th of July 1845, when it died suddenly, having completed the third year of its existence.

On the 27th of June 1842 a young male *Tegenaria civilis* was disengaged from the egg. It quitted the cocoon on the 21st of the following month, and underwent its last moult on the 17th of October 1843. During the winter of 1844 it became greatly reduced in bulk, and died on the 30th of March 1845.

The egg of a *Tegenaria civilis* hatched on the 27th of June 1842 produced a female spider, which completed its final change of integument on the 5th of August 1843. It took its food well, and appeared to be in good health till the 6th of July 1846, when it died, having attained to the age of four years and nine days.

Allowing for the disadvantages to which spiders are subjected in a state of captivity, I think the duration of life in the species upon which the observations were made should not be estimated at less than four years, and I have elsewhere shown (Annals and Magazine of Natural History, vol. xv. p. 232, experiment 4; and pp. 235, 236) that the life of *Segestria senoculata* is protracted to an equally long period. Whether any spiders enjoy a more prolonged existence or not remains to be ascertained; but there can be no doubt that *Dolomedes mirabilis, Clubiona erratica, Agelena labyrinthica, Epëira quadrata, Tetragnatha extensa, Linyphia montana, Theridion lineatum,* and numerous other species, do not usually survive the second winter after quitting the egg in this northern climate.

The following particulars, extracted from observations made by M. Doumerc on *Theridion triangulifer*, are given by Baron Walckenaer in his 'Histoire Naturelle des Insect es Aptères,' supplément à l'histoire naturelle de l'ordre des Aranéides, t. ii. p. 506:—"Prise à la fin de décembre 1839, cette Aranéide fit un premier cocon le 23 avril suivant, les œufs ont éclos le 5 mai; il n'en est sorti que des mâles. Le 10 mai, formation d'un nouveau cocon; le 24 mai, les œufs ont éclos, il n'en est sorti que

des femelles. Le 16 juin suivant, accouplement de l'Aranéide mère avec un de ses petits, mâle, provenant de la première couvée. Deux cocons formés du 26 au 28 juin. Les œufs d'un des deux cocons ont éclos le 27 juillet, et il n'en est sorti que des femelles. Les œufs du second cocon ont éclos le 31 juillet, et il n'en est sorti que des mâles." The events to which attention is here directed are represented as succeeding each other with a degree of rapidity unparalleled in the records of arachnology.

It appears that on the 23rd of April 1840 a female *Theridion triangulifer* deposited in a cocoon a set of eggs which produced young on the 5th of May; they all proved to be males, and on the 16th of the following June one of them paired with its parent, which enveloped a set of eggs in a cocoon on the 26th and a second set in another cocoon on the 28th of the same month; the first set was hatched on the 27th of the ensuing July and produced males only; the second set was hatched four days later, and from it proceeded females only.

Now, though many of the *Theridia* are very short-lived, and, consequently, pass through their several mutations and arrive at maturity earlier than those spiders whose existence is of longer continuance, yet, in my researches into the œconomy of the *Araneidea*, which have occupied a considerable portion of my leisure hours during many years, an instance of the young of these animals becoming adult in the same season that the eggs were deposited from which they were disengaged has never come under my observation; but in the example before us, an egg laid on the 23rd of April is stated to have produced a male spider which on the 16th of the ensuing June was capable of propagating its species. If the small size of spiders on quitting the egg be borne in mind, and if it be taken into consideration also that an advance in growth, particularly of the cephalo-thorax and its appendages, is limited to the periods at which the integument is changed, a suspicion can scarcely fail to be induced that there may have been some latent source of error in the observations of M. Doumerc, which it is very desirable should be carefully repeated. As regards *Theridion triangulifer* depositing two sets of eggs at different times, each of which produced young of the same sex only, one males, and the other females, I will merely remark, that hitherto I have had no opportunity of investigating the œconomy of this species; but that the case is very different with *Tegenaria civilis* conclusive evidence is not wanting, for I have brought up individuals of both sexes from the same set of eggs, deposited in a cocoon by this common and widely distributed spider on the 27th of May 1842.

A passage in the 'Introduction to Entomology,' by Messrs. Kirby and Spence, fifth edition, vol. iv. letter xliv. p. 214, merits

a brief notice; it is this: "Spiders are reputed to be subject to the *stone*: I do not say *Calculus in Vesica*; but we are informed by Lesser that Dr. John Franck having shut up fourteen spiders in a glass with some valerian root, one of them voided an ash-coloured calculus with small black dots." This singular opinion seems to have originated in a misapprehension of an ordinary occurrence, which I shall proceed to explain. If the fæces of spiders, which consist of a white fluid comprising black particles of greater density, happen when voided to be suspended in the webs or among the lines spun by these animals, they assume, under the influence of molecular attraction, the spherical figure common to fluids in general when similarly circumstanced, and soon becoming indurated by desiccation, a change of colour from white to gray or grayish brown spotted with black uniformly takes place, and in this state they constitute, I doubt not, the substance which Dr. Franck mistook for a calculus.

XVIII.—*On some Points in the Structure and Growth of Monocotyledons.* By Arthur Henfrey, F.L.S. &c.*

[With two Plates.]

Although the views which are advocated in the following paper do not possess much originality, I have been induced to lay my observations before this Section by several considerations. In the first place, I believe that the subject is one to which a comparatively small amount of attention has been paid in this country, and therefore, dependent as we have been on foreign observers for our knowledge of it, indigenous investigations may have some interest; secondly, the theories of monocotyledonous structure held by the chief continental authorities are at present not generally-received views, but to some extent individual opinions, conflicting more or less one with another; and, lastly, as I have devoted a considerable amount of time to the examination of this most intricate subject, I have thought that independent observations, carefully and repeatedly made, might by their publication be of some service to the science of Botany, either by pointing out the errors or confirming the statements of other anatomists.

I have directed my attention to the structure of those Monocotyledons which can be readily obtained in a living state in this country; the structure of the stems of Palms I have not had the opportunity of studying, and therefore with regard to them I have been obliged to depend upon the observations of others. So

* Read at the Meeting of the British Association, June 1847, and communicated by the Author.

far as I can at present judge, the various forms are all reducible to two types, which are themselves united under the single common character which was first definitely announced by Schleiden.

Those who are acquainted with his views will recollect that he has pointed out an essential distinction between the characters of the fibro-vascular bundles of Monocotyledons and of Dicotyledons, which in the former are *closed*; that is, their growth in the transverse direction is arrested at a definite epoch, whence results their isolated condition, giving a peculiar aspect to the monocotyledonous stem; while in the Dicotyledons the fibro-vascular bundles not only grow laterally, so as to come in contact with one another as wedge-shaped bodies collectively forming a ring, but their peripherical or external face is capable of development to an extent only limited by the life of the plant in which they exist. Thus the successive layers which add to the thickness of a dicotyledonous stem are produced by the peripherical growth of the fibro-vascular bundles, the distinction into rings, frequently so strongly marked, depending merely on the difference of the condition of those elements of the fibro-vascular bundle produced in the earlier part of the year from that of those formed during the advance of the season.

This is the sole universal character by which the stems of the two great classes can be distinguished. The theoretical distinction into Endogens and Exogens has not a single fact to support it. All plants possessing a stem are Endogens so far as the origination of organs is concerned, since these are developed in buds in the axils of older organs, and, in terminal buds, are immediate developments of the central parenchyma. But the new deposits of fibro-vascular structure belonging to these are found crossing those of the older organs at the earliest period of their development, and always and in all stems come to be applied upon their outer surface. The accounts of endogenous growth are negatived by all those who have traced the development of structure in the Monocotyledons, and could only have been founded on a superficial examination of fully-formed stems. I have traced the development in the buds of many of our indigenous and commonly cultivated Monocotyledons, and they all agree with the characters of that one which I have selected to illustrate this point.

In the accompanying drawings (Pl. IX. figs. 2 and 3) are represented sections of very young buds of *Sparganium ramosum*, and the nascent fibro-vascular bundles are seen in the central portion; the uppermost and youngest, much more delicate and less perfect than the lower, being in direct connexion with the central nascent leaves. The figures also illustrate several other important points concerning the structure of monocotyledonous

stems, of which I shall have presently to speak; before passing to these, however, I must refer to the controversies which exist as to the course of development, in time, of the different portions of the fibro-vascular bundles. Von Mohl offers, I believe, no opinion on this point; Schleiden states that their development commences below and extends upwards into the leaf, in which opinion he is borne out by the statements of several authors, particularly Mirbel* and Naudin†. Gaudichaud‡ states that the development begins in the centre, and that an ascending and a descending portion are gradually organized, one passing to the leaf, the other to the roots.

My own observations are in favour of the former opinion, and indeed Gaudichaud's publications are wanting in proper scientific completeness. His statements are much too dogmatic, and his figures have too much of the character of diagrams, to be received as direct evidence in a case where such complex structures are in question.

In the very youngest part of the bud the nascent leaf is wholly cellular; the cells have generally a spherical form, like those of the other organs and of the conical summit of the stem; the whole are clothed by a delicate epithelium. But in the substance of the stem and nascent leaves are to be remarked certain regions, where the cells, in the earliest condition I have seen them, have a peculiar appearance, being elongated and arranged in parallel rows (Pl. X. fig. 1 *a, a*); in the centre of these bundles of elongated cells first appear the vessels, which are at first unrollable spiral vessels; these regions are in fact the nascent fibro-vascular bundles. These fibro-vascular bundles appeared to me to be always younger and less perfect as they approached the apex, or *punctum vegetationis*. The further development of these elements into the ducts and woody structures found in full-grown bundles I have not systematically followed, as I was more particularly anxious to attain a clear view of their anatomical relation to each other and to the roots.

The condition of the relations of the bundles above indicated is the same as that which exists in most bulbs, and is the form which gives the type characterized by Schleiden as consisting of a stem where the internodial portions are little or not at all developed. I believe that the stem of a solid Palm has essentially the same relative arrangement of the parts. The other type is found in some Palms and in the annual stems of Grasses; this is characterized by the development of the internodes.

In regard to the flowering-stem of the first form we have two modifications to discriminate, depending on the position of the

* Ann. des Sc. Nat. 2 sér. xx. 6. † Ibid. 3 sér. i. 162.

‡ Recherches gén. sur l'Organographie, &c. Paris, 1841.

points where the leaves pass off from the stem, in the full-grown annual stem. In the Crocus, Tulip, Hyacinth, &c., the leaves arise immediately from the base of the flattened stem situated at the bottom of the bulb; the fibres of the peduncle of these plants become developed upwards with the growth of the part in which they are placed, their inferior extremities retaining their relations unaltered below. In the Tiger Lily, Crown Imperial, &c., the leaves are borne upon the elongated stem, and in Asparagus branching of the stem takes place; in this form the lower part of the stem retains the bulb-like character, and the ascending portions of the fibro-vascular bundles become developed upward in the stem before passing into the leaves.

Such stems, examined without reference to the bulb and in the full-grown state, would be liable to be taken for instances of an endogenous growth, since the fibres of the lowest leaves or branches are most external, and those going to the younger leaves and flowers, situated in the centre; but by tracing them downward to the base in the bulb, we there find them crossing to get outside the older fibres. Some of the fibres in the upper part of the stem appear to possess no inferior tract; these may be supposed to originate subsequently during the growth of the flowering-stem, and do not interfere with the general character of the structure.

In speaking of crossing, it must always be recollected that this term is used rather loosely, as the upper bundles take very variable courses to get to the outer side of the lower ones; sometimes their lower tract is found on the side opposite to that on which they ascend, and they succeed one another spirally, so that it is only here and there that a section will exhibit a direct crossing like that usually shown in diagrams.

In the above-mentioned plants the annual stem may be regarded as an inflorescence. In the Grasses and in *Tradescantia* we find several internodes in the annual stem; the fibro-vascular bundles interlace at the nodes, at these points also new fibres arise, and roots are often given off. These nodes may be compared to bulbs succeeding one another upwards at intervals in the stem. In the creeping rhizomata of many Monocotyledons we have examples of bulbs thus succeeding one another; only in such cases they are axillary and not terminal, and they are the *buds* provided for the next year's growth, retained in connexion with the old stem instead of being shed like the *cloves* of true bulbs. In most instances they are sessile one upon another; but in *Sparganium ramosum* we have an example of bulbs succeeding one another with internodes developed, and thus we get, in a perennial monocotyledonous stem, an analogue of the annual stem of a Grass or of *Tradescantia*; for the principal difference

between the two latter is the fistular condition of the stem in the Grass*.

I next directed my attention to the lower extremities of the fibro-vascular bundles, endeavouring to discover their relations with the fibro-vascular system of the roots. Here we meet with several modifications of arrangement.

In the stems I have examined the lower ends of the fibres appear to branch and to anastomose with their fellows, sometimes forming a distinct fibrous layer. In order to explain the relations of these extremities, I must point out some peculiarities in the cellular system.

Von Mohl has described in the stems of Palms a central region, a fibrous layer, and a cortical region. The analogues of these appear to me to be present in most monocotyledonous stems. The tissue of the central region is generally composed of spherical cells which contain abundance of starch at certain periods; this region, in which lie the fibro-vascular bundles, undoubtedly represents the pith and medullary rays of Dicotyledons. The cells of the cortical region are usually very irregular in form, and have large intercellular spaces; they contain little or no starch.

In bulbs the central region is inclosed by rather a thin layer of the cortical parenchyma, which is continuous with the bases of the coats or scales; the line of junction of the two regions is indicated in the very youngest state of the bulb by a darker colour and greater density of the tissue. At this line the fibro-vascular bundles terminate below, and their extremities, by branching and anastomosing, frequently produce a dense layer, the "fibrous layer" of Von Mohl. The cortical region cannot be made out in the culms of the Grasses, and it is not continued distinctly into the flowering-stems of bulbs. In *Sparganium ramosum* it is very much developed, both in the nodes and internodes; in the former it exhibits fibres crossing transversely, and thus *weaving*, as it were, the whole into a dense fibrous coat separating the central from the cortical region.

The most important point relating to the fibrous layer is, that it gives origin to the roots, for there is no direct communication between the fibro-vascular bundles of the stems and those of the roots. The bundle which lies in the midst of the root of *Sparganium*, and indeed of all the annual roots I have examined, is composed of a number of vessels arising in a circle from the

* An illustration of this analogy between the nodes of the stem of a Grass and bulbs, physiologically denoting a certain degree of independence, seems to me to be offered by the possibility of *grafting* grasses upon one another at the nodes. This has been effected by an Italian botanist, Calderini, in the Millet, and he also successfully grafted Rice upon *Panicum Crus-galli*.—See Ann. des Sc. Nat. Sept. 1846.

fibrous layer; they gradually approach one another as they pass out, thus forming a kind of funnel-shaped body. The central parenchyma is gradually converted into ligneous cells as the tube of vessels extends outwards (Pl. X. figs. 2 and 3), and the root at a short distance from its point of origin presents in a cross section a central cylinder of wood having a ring of vessels near its periphery, the whole being inclosed in a parenchyma continuous, near the fibrous layer, with the cortical layer of the stem. When the roots produce branches the latter are given off at right angles (Pl. X. fig. 2), and arise on the central fibro-vascular cylinder, bursting their way through the cortical parenchyma of the root as the main roots do through the outer part of the cortical layer of the stem. When the roots fall off, they leave orifices in the stem where they have thus burst through. Roots appear very early in the buds, in fact contemporaneously with the leaves. In the section of the apex of a bud of *Sparganium* (Pl. IX. fig. 3) they are seen in the nascent condition. It is disputed whether the fibro-vascular bundles are first perfected where they are in contact with the fibrous layer, or whether their bundles are formed independently and afterwards effect a junction. With regard to the roots of *Sparganium,* just noticed, I believe their central bundle is organized contemporaneously and in continuity with the fibrous layer.

The fibrous layer is not so distinctly marked in bulbs like the Tulip and Hyacinth, or in tuberous-rooted Monocotyledons like Asparagus and the terrestrial Orchidaceæ. The ends of the fibro-vascular bundles of the stem are found branching and anastomosing at the line of junction of the cortical and central regions, and the bundles of the roots are in connexion with these plexuses. The tubers of *Orchis mascula* are merely enlarged roots; the difference between them and the other roots arises from the development of the central (otherwise ligneous) portion into a parenchymatous mass, which breaks up the ring of vessels, and carries them to the outer region of the tuber.

The development of successive roots taking place from below upwards, the younger roots arise from parts of the fibrous layer in relation with the younger fibro-vascular bundles. In cases where the internodes are developed, roots and buds are commonly produced at the nodes, as in *Tradescantia,* Grasses, and *Sparganium;* in the latter, roots are also formed irregularly on the internodial parts of the stem * (Pl. IX. fig. 1 shows the scars left by their fall).

* The *endorhizal* mode of producing roots seems to be a constant character of Monocotyledons as well in the full-grown condition as in the embryo. It is also found in Nymphæaceæ, which present many points of affinity with monocotyledonous structure.

There is another point in the structure of Monocotyledons which does not appear to me to be clearly understood. In the cortical region are often found fibrous bundles, passing into the leaves above, and which, in the cases I have examined, possess no vessels, and consequently have the character of liber bundles. In *Sparganium ramosum* they are very numerous and of considerable size; they are also found in the Grasses, and apparently in all such stems as have the internodial portions developed. I cannot find them in bulbs, or in such rhizomes as the common Iris; but in the flowering-stem of many such plants, *ex. gr.* the Tulips, Crown Imperial, Tiger Lily, &c., the parenchyma gradually changes its character towards the periphery, and just within the epidermal layers it consists of long fibrous cells exactly resembling liber cells. This ring of woody cells is very much developed in *Tamus communis* and *Smilax aspera* (and I believe in most plants belonging to the same orders), and has been taken for a layer of wood analogous to that of Dicotyledons; but this is certainly a misconception, as it is distinctly defined at its outer border, and does not present the slightest trace of a developing or cambium layer. Internally it passes insensibly into the central parenchyma of the stem, in which lie the true woody bundles having vessels as usual. If this has an analogue at all in Dicotyledons, it is the liber; and there are many reasons in favour of such an hypothesis, especially if we consider it as identical with the fibres of the cortical layer of such stems as *Sparganium*.

In conclusion, adverting to the discussions as to the mode of increase of the stem of Monocotyledons, it seems to me that many writers do not sufficiently consider the peculiar characters of this organ. This question must not at all be mixed up with that of the formation of new layers of wood in Dicotyledons, since in all the usual forms (making exception of such as *Dracæna, Cordyline,* &c.) nothing analogous to the second year's layer of wood is ever produced. In bulbs the buds are thrown off; in branching rhizomes they become independent physiologically, and the old stem never increases; while in the Palms, the bud, though continually developing, merely applies a new layer spirally upon the pre-existing portions, so that the new growth might be roughly exemplified by a series of hollow cones of *equal* size placed one upon another. Here all growth is analogous to the upward growth of the terminal bud of a dicotyledon; there is no cambium layer, and no peripherical increase*. The

* For every year's development of the terminal bud of a dicotyledon we find a new layer deposited all over the old wood by the cambium layer, forming a new annual ring; in Palms we have merely the terminal shoot without any analogue of the annual ring.

greater consistence which the older parts of the stems of Palms acquire is to be regarded as arising from causes similar to those producing the peculiar characters of the heart-wood of Dicotyledons.

DESCRIPTION OF THE PLATES.

Plate IX.

Fig. 1. A branching rhizome of *Sparganium ramosum*, exhibiting the nodes, *a*, and the internodes, *b*; in the latter the fibro-vascular bundles take straight and parallel courses.

Fig. 2. Half of a vertical section through a terminal bud, showing the relative positions of the developing bundles. *a*, the central parenchymatous region, in which the bundles lie; *b*, the line where the fibrous layer is formed by the lower extremities of the bundles; *c*, the cortical region in which lie the liber (?) bundles; *d*, the *punctum vegetationis.*

Fig. 3. A similar section; the references are the same; *e e* are nascent roots (figs. 2 and 3 are magnified six diameters).

Fig. 4. A portion of the cortical region with liber (?) fibres continued into the leaves.

Fig. 5. Vertical section of a full-grown node (like *a* of fig. 1), prepared by maceration, so as to exhibit the fibro-vascular bundles *in situ*. *a*, the bundles; *b b*, axillary branches forming the internodial portions (like *b* in fig. 1); *c*, the cortical region, now a mass of fibres; *d*, the fibrous layer, which presents several layers of densely interwoven fibres derived from the lower extremities of the bundles of the central region.

Fig. 6. Transverse section of an internode (*b* in fig. 1). *a*, the central region; *b*, the fibrous layer; *c*, the cortical region, here very much developed.

Fig. 7. Vertical section of the same. *a*, *b*, *c*, same references; *d*, a root, the central fibro-vascular bundle of which is seen arising from the fibrous layer. The root breaks down the substance of the cortical region when making its way out. The fibro-vascular bundles of the stem are parallel here, and the slender liber (?) bundles are shown in the cortical region *c*.

Plate X.

Fig. 1. Highly magnified vertical section of a bud. *a*, the nascent fibro-vascular bundles.

Fig. 2. Transverse section of a portion of an internode. *a*, the central region; *c*, the fibrous layer giving off the vessels to the root *g*; *d*, the cortical region; *e*, liber (?) bundles; *f*, epidermis (enlarged about five times).

Fig. 3. Part of the same highly magnified. *a*, the parenchyma of the central region of the stem gradually becoming converted into ligneous cells as it passes into the centre, *b*, of the fibro-vascular bundle of the root; *c*, the ducts which are given off from the fibrous layer to form the vessels of the root; *d*, the cortical parenchyma of the stem.

Fig. 4. Magnified section of the cortical region, showing the large intercellular spaces (the cells of this tissue are extremely irregular in form, and contain no starch granules). *e*, a liber (?) bundle.

XIX.—*Some observations on* Caladium distillatorium. By Mr. Francis Williamson.

To the Editors of the Annals of Natural History.

Gentlemen,

Having obtained from Mr. Williamson, late Curator of the Sheffield Botanic Garden, an account of a plant in that collection, to which he has given the name of *Caladium distillatorium*, and thinking it well-worthy of preservation, I beg to entrust it to your care. I remain, yours respectfully,

Norton Hall, Derbyshire, Jan. 27, 1848. James Yates.

Sir, Broom Hill, Sheffield, Dec. 28, 1847.

I feel a pleasure in complying with your request by giving you an account of a few of the most striking peculiarities of that interesting plant, the *Caladium distillatorium*.

This is perhaps the most gigantic species of the family, and when well-grown possesses many peculiarities to the casual as well as the botanical observer. In the beginning of the winter of 1844 a small tuber two inches in length by half an inch in thickness was imported from Bahia in South America. Towards the spring of 1845 it showed itself to be a *Caladium* of gross habit; early in April it had leaves upwards of twelve inches long. The pot in which it stood, six inches in diameter, being full of roots, made it necessary to transfer it to one of upwards of twelve inches, which soon also was filled, the plant daily increasing in magnitude. In June it was removed as a permanent shift to the half of a wine-pipe. The plant now became exceedingly interesting to every beholder. The beautiful, smooth, green, heart-shaped leaves, their pleasingly graceful outline, the singularly shaded and attractive arrangement of the veins, and umbrageous shade from the majestic leaves high over head, may be more readily comprehended by the fact, that from a measurement taken in September—

The foot-stalk of the leaf alone, from where it embraces the trunk or stem to its insertion into the disc of the leaf,	9 feet 6 inches.
The disc taken at its greatest length . . .	6 feet 6 inches.
The disc taken at its greatest breadth . . .	3 feet 9 inches.
Length of the trunk or stem about	1 foot 6 inches.

In the night-time each of the leaves had the peculiar power of distilling water by a somewhat pulsative action from an orifice near the apex of the leaf on the upper side. Around the margin of the leaf is a large duct or channel into which the larger veins empty themselves, and thus convey their contents to the

above-mentioned orifice at the apex of the leaf, from whence it is thrown forth by pulsation. At each pulsation a small globule of clear tasteless water was ejected. Each drop, as it fell from the leaf, contained fifteen of these globules, and eleven drops fell in the course of a minute. This action begins with the shades of the evening and continues until the heat of the sun changes the course of action. Each full-grown healthy leaf will produce about half a pint of water during the night, which on being analysed has been found to contain a very minute portion of vegetable matter. The veins which flow into this duct may be distinctly traced by the light of a candle (the leaf being held between) from the body of the leaf to the midrib, and from thence followed down perhaps the one-half of the foot-stalk, where, from the colouring matter of the leaf becoming denser, they are ultimately lost sight of. There is also a smaller duct which runs parallel to the larger and nearly close to it, the use of which is not so clearly marked, but from observation it appears to be connected with another series of vessels running from it towards the interior, but terminating before they reach the midrib.

From the time the plant began to grow rapidly in April, its treatment was after the following manner:—Some turf, that had been cut from an old pasture a few months before, being chopt into pieces in the form of brickbats, *all the loose small earth being taken away,* a small portion of rough charcoal and half-decayed dry manure was added, which, being chiefly fibrous, allowed water to be given copiously, and admitted the roots freely to feed on the vegetable matter. There are but few kinds of plants that will not thrive in a most luxuriant manner treated in this way. As a finish in potting, a small portion of a fine mixture of soil on the surface gives neatness, as well as prevents too great an action of drought in drying weather.

I am, Sir, yours most obediently,

J. Yates, Esq. FRANCIS WILLIAMSON.

XX.—*Additions to the British species of Nudibranchiate Mollusca.* By JOSHUA ALDER and ALBANY HANCOCK*.

SOME new forms of Nudibranchiate Mollusca have occurred to us during the last and part of the preceding years, of which we now purpose giving an account.

And first we would notice the interesting addition made to our fauna by the discovery of *Scyllæa pelagica* on the British shores. This well-known inhabitant of the deep was found by Mr. W. P.

* Partly extracted from a paper read at the British Association Meeting at Oxford.

Cocks among a mass of sea-weed thrown up after a storm at the mouth of Falmouth harbour. Three specimens were obtained, one of which Mr. Cocks kindly sent to us in spirits. The dissection of this specimen has shown a peculiar modification of the digestive system which appears to have been overlooked by Cuvier, and the particulars of which will appear in the 4th part of our 'Monograph of the Nudibranchiate Mollusca.'

Another species of great interest and beauty is apparently new, and very nearly allied to our genus *Proctonotus,* but differs from it principally in a peculiar crest-like body uniting the dorsal tentacles. It probably belongs to the genus *Janus* of Veramy, so far as we can judge from the notice of that genus inserted in the Reports of Zoology lately published by the Ray Society; but whether or not this may be the case, which we have not the means of verifying at present, the name of *Janus* being pre-occupied in entomology, we propose now to describe it under the generic name of *Antiopa,* and to characterize it as follows:—

Genus Antiopa.

Body ovate, rather depressed and tapering to a point posteriorly. *Tentacles* four: the dorsal pair linear, laminated, non-retractile, and united near their base, for a short way up, by a fleshy crest. *Head* anterior and inferior, without veil, but having two short cylindrical oral tentacles. Jaws corneous. *Branchiæ* papillose, elongated, clothing the sides of the back and extending round in front of the head. *Anus* posterior-dorsal, on the median line. The digestive system supplied with two lateral trunks which give off branches to the papillæ. Common aperture of the generative organs on the right side.

Antiopa splendida.

Body of a transparent buff or lemon colour, and rather elongated. Dorsal tentacles tapering and strongly laminated in an oblique direction; united below by an arched, semicircular laminated crest, which is placed longitudinally between them. Branchiæ very numerous, large and inflated, clothing the sides of the back and passing round the front of the head. When held erect they conceal nearly the whole of the body. They are ovate, very transparent, of a pale buff-colour, and have a narrow, linear, brown central vessel, which bifurcates at the top. The apex of each papilla is of a brilliant opake bluish white with a metallic lustre, deepening into ultramarine blue below. They are set in about thirty transverse rows on each side uniting in front, each row containing about five papillæ; the inner ones large and inflated, those next the foot small. The back is blotched with metallic blue. Head subtriangular, the sides forming a kind of

hood, with two short oral tentacles. Foot lemon-yellow, transparent, rather broad and arched in front, with a notch in the centre and very obtuse angles at the sides. The sides are thin and undulated, tapering gradually to the tail, which is a little produced beyond the branchiæ. Length an inch and a quarter.

There is a very conspicuous aperture at the end of each papilla, which is opened and closed at intervals. When closed the papilla terminates in a point, but the apex has a rounded form when the aperture is opened. The gastric vessels are very visible through the skin, running along each side of the back and branching into the papillæ, giving that part a dendritic appearance.

The first specimen taken of this fine mollusk was dredged in Torbay by Dr. Battersby, and communicated to us through the kindness of Mrs. Griffiths. We afterwards dredged three or four in Fowey Harbour, Cornwall.

Tritonia lineata.

Body very slender, pellucid white, with an opake white line along each side of the back, which is curved a little outwards opposite each branchial tuft. Veil produced into four long filaments; the two nearest the centre longest and tapering gradually to a point, the side ones shorter and obtuse. Tentacles pale yellow, the fasciculæ of filaments slender, and the sheaths rather tight. Branchiæ rather slender, bipinnate, transparent, with an opake white line in the centre of each running into those on the back. Foot slender, rounded in front and terminating in a point behind. Length half an inch.

This beautiful new *Tritonia* was discovered under stones at Scarborough in September 1846, while we were exploring the rocks in company with Mr. Bean.

Eolis Peachii.

Body rather flat, yellowish white. Dorsal tentacles longish and smooth. Oral tentacles shorter. Head broad and rounded, angulated at the sides. Branchiæ very numerous and thickly set, passing round the dorsal tentacles so as nearly to unite in front, and terminating behind very near the tail. The papillæ are nearly linear, slender, with a brownish central vessel, and having the apices sprinkled with opake white spots. Foot rather thin and broad, arched in front, with obtuse angles. Length three-quarters of an inch.

An adult specimen was dredged by Mr. Peach in Fowey Harbour, and we got two or three young ones from the same locality. More recently we have obtained a single individual at Cullercoats.

Eolis exigua.

Body slender, yellowish white with olive or pale brown markings. Dorsal tentacles linear, moderately long, with a ring of brown near the top : oral tentacles about one-third shorter and of the same colour. Branchiæ generally in a single series of five or six on each side, but in fine full-grown specimens there are two on each side in front or sometimes a cluster of three, the third being placed a little behind the others. There is also frequently an additional papilla united with some of the others behind. They are ovate, tapering abruptly to a point : there is a ring of olive or yellowish brown, sometimes reddish, at a short distance from the apex, and frequently two others, less perfect below, but generally these are only indicated by brown spots or streaks. The body is also blotched and spotted with brown, and there is frequently an interrupted line of that colour on each side. Foot rounded in front and nearly linear, with a slight margin of pale brown at the sides. Length $1\frac{1}{2}$ to 2 lines.

This species was found in considerable abundance in Fowey Harbour on *Laminaria saccharina.* Mr. Cocks has also found it at Falmouth. It is allied to *Eolis despecta,* some specimens of which were found in company with it, but it is easily distinguished by not having the waved dorsal line of the latter species. It appears to be the *Tergipes lacinulatus* of Professor Lovèn, but we cannot concur in referring it to the *Limax tergipes* of Forskahl (*Doris lacinulatus,* Gmelin).

XXI.—*Note on the Occurrence of the Bonapartian Gull* (Larus Bonapartii, *Rich. and Swains.*) *for the first time in Europe.* By Wm. Thompson, Esq., Pres. Nat. Hist. and Phil. Society of Belfast.

A specimen of this beautiful little species of Gull (first distinctly characterized in the 'Fauna Boreali Americana' of Richardson and Swainson in 1831), was killed at the tidal portion of the river Lagan, between Ormeau Bridge and the Botanic Garden, about a mile above the lowest bridge at the town of Belfast, on the 1st of February 1848. It was flying singly. The person who shot the bird, attracted by its pretty appearance merely, left it to be preserved with a taxidermist, who on receipt of any birds, either rare or unknown to him, kindly brings them for my inspection. I had thus most fortunately an opportunity of examining the bird previous to its being skinned, when all the following measurements, &c. were made. This was not however until the morning of the 5th of February, when the irides had faded so that the colour could not be accurately noted.

The species is mentioned in the work referred to (p. 425) as "common in all parts of the fur countries, where it associates with the Terns, and is distinguished by its peculiar shrill and plaintive cry." Mr. Audubon (Orn. Biog. vol. iv. p. 212, 1838) informs us, that he first met with the species in August when crossing the Ohio at Cincinnati, and subsequently shot a specimen in November on the Mississippi, a few miles below the mouth of the Arkansas. In Chesapeake Bay after the first of April, and at the harbour of Passamoudy (Maine) in May, he saw them in great abundance:—at the latter place his son killed seventeen at one discharge of his double-barreled gun. It is added that "none of them were observed on any part of the Gulf of St. Lawrence, or on the coast of Labrador or Newfoundland, and that in winter this species is common in the harbour of Charleston, but none are seen at that season near the mouths of the Mississippi." This author subsequently "found in London a pair of these birds * * * which had been brought from Greenland."

The dimensions of my specimen are:—

	in.	lin.
Length, total	13	9*
Length of bill from forehead	1	1
——— bill to rictus	1	9
——— wing from carpal joint to end primaries	10	4
——— tarsus	1	4½
——— middle toe	1	2½
——— middle toe nail	0	2½
——— of outer toe	1	1½
——— outer toe nail	0	2
——— inner toe	0	11
——— inner toe nail	0	2
——— hind toe	0	2
——— hind toe nail	0	1
Tibia bare of feathers from tarsal joint	0	6
Wings, pass the tail	1	9†

Bill in form as described by Richardson, excepting that at the base its depth exceeds its breadth. At the base of the upper

* As measured by applying a piece of twine so as to touch each portion of the bird in a straight line from the point of the bill to the end of the tail. The bird being laid on a flat surface, the space which it occupied from the point of the bill to the end of the tail was 12 inches 6 lines. The length of three specimens given in the 'Faun. Bor. Amer.' was from 15 in. to 15 in. 6 lines. Looking to that work after my measurement was made, and too late for correction (the bird being skinned), I found that the neck is stretched when the length is taken, whereas in this and every similar case, I have been particular that it should never be in the least stretched, but placed as it were in repose. Audubon describes the adult male as 14⅛ inches and the "young in December as 13⅜ inches."

† The figure of the adult bird in the 'Faun. Bor. Amer.' does not sufficiently exhibit the length of wings:—they are described in that work as passing the tail two inches.

mandible where the plumage ends, it is $2\frac{1}{2}$ lines in breadth, whereas the depth at the same place is $3\frac{1}{2}$ lines. In colour it is black; paler at the base beneath. Tarsi, toes and webs of feet of a uniform pale flesh colour as the "legs" of the young male are described to be in the 'Faun. Bor. Amer.' These are described as "carmine-red" in the adult. In the specimen under examination they are just the colour that I have remarked those of the nestling *Larus ridibundus* to be, and which it retains through the following autumn and winter; the adult of this species having these parts of an arterial blood-red. The claws are blackish and dark brown. Inside of the mouth pale reddish flesh-colour:—described to be carmine in the adult. The tail may be termed even at the end, "very slightly rounded laterally." The beautiful long tern-like wings were to me the most striking character at the first glance, and indicated what it was afterwards found had been remarked by Audubon, viz. that—"the flight of this gull is light, elevated and rapid, resembling in buoyancy that of some of our Terns more than that of most of our Gulls, which move their wings more sedately."

Plumage. Head white, excepting the usual blackish seasonal ear-spot of *Xema*; a little of this colour before the lower portion of, and beneath the eye, and a little above it posteriorly—also blackish mixed with white on the nape. Thence to the back very pale pearl gray; back or mantle ("manteau," Temm.) pearl or pale bluish gray. Tail pure white except from about a line inwards from the tip, where a band of black nearly an inch in breadth appears. The wings exhibit generally the bluish gray of maturity, but have "clove brown markings on the bastard wing, lesser coverts and scapulars; anterior border of the wing white from its shoulder for the breadth of four greater primary coverts." *Primaries* exhibiting *in degree* considerably more black than the specimen described in 'Faun. Bor. Amer.'—outer margin of the first entirely black; of the second, from tip upwards for $5\frac{1}{4}$ inches black, thence white; of the third, from the tip upwards black for 4 inches next the shaft, for $3\frac{1}{4}$ inches on outer margin*. Remainder of the primaries terminated with brownish black except at the extreme tip. On the third, the first indication of white appears in a mere line of that colour, thence it becomes gradually larger in size and deeper in shade to the seventh, where it assumes the pearl gray of the lower portion of the same feather. The black becomes more and more tinged with brown from the

* Dr. Richardson remarks that,—"the extent of black on the ends increases gradually from the first to the fourth, on which it measures above an inch, diminishing again in the following ones." In my specimen the extent of black increases gradually only to the third, in which it is $1\frac{1}{2}$ inch in depth, and diminishes in the succeeding feathers.

first primary to the last; the light-coloured tip on the contrary becomes gradually of a deeper shade from the third to the last.

Shafts of all the primaries white, except the upper portion of the first, which is dusky. Black appears on the inner web of the three longest primaries, much lessening both in length and breadth from the first to the third; in the first it occupies four inches in length, and its greatest breadth from the shaft is 4 lines ($\frac{1}{3}$ inch).

The secondaries exhibit a large space of blackish brown towards the tip within their pearl gray margins; the tertiaries have more or less of blackish brown irregularly disposed towards their tips.

Under surface of wings entirely white, except that the portions of the primaries, secondaries and tertiaries, which are dark above, appear grayish. Entire under surface of body from the bill to the extremity of the under tail-coverts white, of an extremely faint roseate hue. The bird would I consider have attained full plumage at the next moult. The weight was $5\frac{1}{4}$ ounces. It proved a male on dissection. The stomach contained the remains of two specimens of opossum shrimp (*Mysis*), a little vegetable matter, and some small pebbles.

The occurrence of this North American bird in Europe affords another opportunity for speculating whether birds can really cross the Atlantic, which some of the best ornithologists in Europe did not, at least a few years ago, believe to be possible. In my opinion, as fully stated on former occasions when noticing the occurrence of American birds in Ireland, the presumptive or circumstantial evidence is all in favour of their having really crossed the ocean*.

In the estuary, about three miles from where the *Larus Bonapartii* was shot, the first individual also of

LARUS SABINI,

known to visit the European coasts (as recorded by me in 1834), was met with; and at the opposite side of the bay a second example was afterwards obtained. Since I first noticed the species, a few individuals have been procured on the shores of continental Europe. This opportunity of noticing a very rare and closely-allied species to the preceding may be embraced, although it is not American, nor has it been obtained there but in a single instance †:—I allude to the

LARUS MINUTUS,

a beautiful adult example of which was shot in the estuary about

* See Yellow-billed American Cuckoo (*Coccyzus Americanus*) in 'Annals,' vol. ix. p. 226, and American Bittern (*Botaurus lentiginosus*) in same work, vol. xvii. p. 94.

† 'Faun. Bor. Amer.' p. 426. The species is not included in the Prince of Canino's subsequently published list of North American Birds.

three miles from Belfast on the 23rd of December 1847. It came under my examination within an hour after being killed, and a full description of it was drawn up. This bird was preserved by Mr. Darragh, the Curator of the Belfast Museum, who possesses a critical knowledge of our native birds generally, and who, when visiting Strangford Lough in January last, a few weeks after having set up the specimen, saw another of these birds both on the 18th and 19th of that month at Rough Island. It was also adult, as denoted by its pure white tail. The diminutive size of the bird first attracted his attention, and he had the advantage of seeing it very near both on wing and on the ground. The dark colour of the under side of the wings was conspicuous; the tail was square at the end (not cuneate as in *L. Rossii**, nor forked as in *Lar. Sabini*). The upper surface of the wing, including the primaries, was particularly remarked to be wholly of a light colour. My informant's fear of injuring the bird as a specimen with the large shot in his gun prevented his firing at it when seen the first day; and on the second day, he had crept for a long way—after the manner that Mr. Scrope graphically describes the deer-stalker to do—and though enabled unseen by the wished-for victim to observe it attentively for some time from behind stones on the beach, and at the distance of about fifteen or twenty paces, he could not bring his gun to bear upon it without alarming it. In his attempt to do so the bird took wing, but the rough nature of the ground prevented his steadying himself so as to get even a parting shot at it. The little gull has been hitherto known in Ireland only from a single example; a beautiful bird in adult summer plumage having been shot on the river Shannon in the month of May 1840.

We cannot think of the occurrence of the three preceding species of *Xema* or Black-headed Gulls within so limited an area, without reflecting that many species of birds of which we are now ignorant, may visit the British coasts. If in the estuary at Belfast, on the eastern coast of Ireland, North American species are thus met with, how much more likely are they to visit, unnoticed by any one, the western and northern coasts of the island, as well as those of Scotland!

Of the other *Xemæ* known as British, *X. ridibundus* and *X. capistratus* (regarded by me as one species†) are common in the

* This species is noticed under the supposition that it may in winter lose the black collar, which would otherwise distinguish it. A specimen of *L. Rossii* is said to have been obtained on the Yorkshire coast last year.

† See Zool. Proceedings, 1845;—copied into the 'Annals,' vol. xvi. p. 357, and Yarrell's 'Brit. Birds,' 2nd edit.; preface, p. xi. In the three works, the last word of the foot-note is printed "hood" instead of *head*.

locality indicated for the others*; the remaining one, *X. atricilla*, has been observed on two occasions on the south coast of England, and by Montagu only. Of the two† additional European species, *X. melanocephalum* and *X. ichthyaëtum*, the former inhabits "southern," the latter "south-eastern" Europe. *Xema Franklini* is the only North American species which has not been obtained in Europe.

XXII.—*On the Insects of Jamaica.* By Philip Henry Gosse.

[Continued from p. 115.]

Coleoptera.

1. *Cicindela Guadalupensis.* I found this species in some numbers about the end of the year at Alligator Pond, on the sandy beach, close to the wharf; where the *Canavalia rosea* grows, and the beautiful *Convolvulus pes capræ* makes a carpet of verdure, and trails its long stems over the heavy sand. In May it was numerous at low-water on a little sandy (or perhaps rather muddy) point at Bluefields Creek, formed from the draining of the morass at the junction of the creek with the sea: immense numbers of little *Gelasimi* run over this point, and perforate it with their burrows in every part. Among them the *Cicindelæ* also run when it is not covered by the tide. They are as wary and as agile as their congeners elsewhere; on the wing with the approach of a footstep, and alighting at the distance of a few yards, so as to be caught with difficulty even with a net. I have taken them by running headlong among them, and making a dash at random with the net.

(*Carabidæ.* Two or three small species of this great family, I believe, occurred under stones at the summit of Bluefields Mountain, but I cannot now find the specimens so as to determine their genera.)

2. *Cybister lævigatus.* In some of the rivulets that cross the high road between Paradise and Savanna le mar. Its manners resemble those of the English *Dyticidæ.*

3. *Copelatus cælatipennis.*

4. *Dineutes longimanus.* At Basin Spring, in a brook having

* The species of *Larus* (as distinguished from *Xema*) frequenting Belfast Bay are *L. marinus*, *L. fuscus*, *L. argentatus*, *L. canus*, *L. tridactylus* and *L. Islandicus*; all of which are common but the last:—it was once obtained. Specimens of these, as well as of the *Xemæ* noticed from the same locality, are preserved in the Belfast Museum.

† *X. plumiceps*, Bonap., is not enumerated in the 'Wirbelthiere Europa's' or 'Rev. Crit. des Oiseaux d'Eur.' (Schlegel).

an elevation of (perhaps) 1500 feet, I found in March several groups of this *Gyrinus*. Their manners were much like those of *G. natator*, but they were less rapid in their evolutions, and when diving did not show any little pearl of air at the extremity of the body. They huddled together more: at one dash of a small ring-net I took forty-five. I subsequently saw the same species at other seasons of the year in the same brook.

5. *Dineutes metallicus*. In a brook between Paradise and Savanna le mar in April.

6. *Creophilus villosus*. On two occasions I have observed this beetle crawling and flying about animal substances in a state of putrefaction. It has an extensive range, for in Newfoundland it is so abundant about the drying cod-fish as to be quite a pest; and I have found it also in Canada and in Alabama, U.S.

7. *Philonthus* (sp. nov.). On the Hampstead Road is a grove of rose-apple trees (*Eugenia jambos*); when this fruit is ripe the stone is loose, not nearly filling the cavity that incloses it. In the decaying rose-apples beneath the trees I found this little beetle common, together with a minute *Nitidula*; two or three being in the cavity of almost every decayed fruit. I do not apprehend that they are able to get into the cavity until a part of the pulp is destroyed by decomposition, but contact with the earth soon effects this. In no case were they in a sound fruit, though several in such condition lay beneath the trees. The season was the latter part of June.

8. *Belonuchus* (sp. nov.).

9. *Osorius* (sp. nov.). At the summit of Bluefields Peak in March, I found this beetle in some numbers beneath the rotting bark of a fallen tree.

10. *Osorius* (sp. nov.). Considerably less than the preceding: beneath a stone, on Bluefields Mountain, March 12th.

11. *Pœderus connatus* (Haliday). A curious little species, apparently destitute of both wings and elytra; the latter are however discernible by the aid of a microscope, but soldered together.

12. *Phanæus* (sp. nov.). Common on the roads, rolling pellets of horse-dung: it chiefly occurs in the lowlands.

13. *Onthophagus* (sp.). Bluefields, in December.

14. *Trox* (a sp. near *murinus*).

15. *Oryctes Jamaicensis*. Three or four specimens of this species were brought to me at different times; all found near Bluefields, and (as I believe) in the earth of cultivated grounds.

16. *Megasoma titanus*. Repeatedly brought to me, but I never found it alive. I have taken, however, the great horned males from the stomach of *Nyctibius Jamaicensis*, whence I infer that it flies by night.

17. *Cyclocephala signata*. Very abundant at almost all times;

flying in at the open windows, attracted by the candles, crawling in great numbers over the tables, wading through the gravy, or drowning itself in the tea. It is commonly known by the name of Christmas Bug, from its increased abundance at the end of the year.

18. —— ? *Crœsus* (*Scarabæus Crœsus,* Newm.). This species seems to belong to an undescribed genus, and was previously known by a single specimen in the collection of the British Museum.

19. *Podalgus* (sp.). Taken at New Forest, near Alligator Pond, in December.

20. *Chalepus geminatus.* Flew into the house at Bluefields in May, attracted by the lights in the evening.

21. *Chalepus* (sp. near *geminatus*).

22. *Macraspis tetradactyla.* In May and June this glossy black species of the family *Rutelidæ* is abundant around blossoming trees. Both at Sabito and at the Hampstead Road we have observed it so numerous about certain trees as to give notice of its presence some time before we came near by the loud buzzing of the scores that were flying around the summit, while on approach the tree appeared quite blackened by the multitudes that were resting on every twig. On giving the tree a smart blow with a stick, the sudden rush into the air of hundreds of these beetles was really a spectacle worth seeing, and the noise produced by their wings was like that of a swarm of bees. The tree provincially called Potato-wood seems to be the kind chiefly resorted to by these assemblages. In May a piece of rotten wood was brought me, in which were many of this species, in the larva, pupa, and recently-evolved imago.

23. *Gymnetis lanius.* This is comparatively a scarce insect. A single one is occasionally seen in the spring, buzzing around a flowering bush, in the lowlands.

24. *Passalus interstitialis* ? or *tlascala* ?. Several were found beneath the rotting bark of a fallen tree, on the very summit of Bluefields Peak, in March.

25. *Polycesta* (sp. nov.). Found resting on a twig of a tree overhanging the high road near Content, in June.

26. *Psiloptera* (sp. nov. near *torquata*). This fine *Buprestis* was found in considerable numbers in June, resting on twigs of the lignum-vitæ tree (*Guaiacum officinale*), in an arid plain of very peculiar vegetation, just behind Pedro Bluff. I found the insects of this plain almost totally different from those found at the leeward part of the island. The elevation is scarcely above the level of the sea, the soil is sand, the trees scarcely attain a greater height than twelve feet, and therefore the heat of the sun is peculiarly intense. An hour or two in the middle of one day

in the very height of the summer afforded the only opportunity I had of examining this very singular region.

27. *Chrysodema corusca.* The Hampstead Road is the only locality in which I have found this brilliant insect; but there in the latter part of May and the beginning of June it is very abundant. It is almost invariably found resting *on the foot-stalks of the leaves* of joint-wood and other tall shrubs that over-hang the sides of the road. When approached, though as yet the bush is untouched, each one warily shifts round, so as to keep on the opposite side of the stalk, exactly as the little *Tettigoniæ* do on the stalks of grass. The moment a finger is put near it, down it drops; so that we found the best way to capture it was to hold the ring-net beneath the twig and just tap the bush, when the beetle would drop into the net.

28. *Chrysobothris* (sp. nov.). An exceedingly lovely little insect, green with crimson bands. I took it as it alighted from flight at Phœnix Park, near Savanna le mar, in April.

29. *Agrilus* (sp. nov.). One of the fish-tailed group; curiously marked with two large orange spots on each side of the abdomen. Taken in June, both at Sabito and on the Hampstead Road.

30. *Agrilus* (sp. nov.). The thorax and forehead rich crimson. Taken at Hampstead Road in June: a single specimen.

31. *Agrilus* (sp. nov.). A pretty little black species, with the thorax and the tips of the elytra white.

32. *Pyrophorus noctilucus.* From February to the middle of summer this beetle is common in the lowlands, and at moderate elevations. Lacordaire's account of the luminosity of this *Elater* (known to me however only by the citation in Kirby and Spence's Introd. to Ent. ii. 333, 6th edit.) differs so greatly from the phænomena presented by our Jamaica specimens, that I cannot help concluding that he has described an allied but very distinct species, and I feel justified therefore in recording what I have myself observed. The light from the two oval tubercles on the dorsal surface of the thorax is very visible even in broad daylight. When the insect is undisturbed, these spots are generally quite opake, of a dull white hue; but on being handled they ignite, not suddenly but gradually, the centre of each tubercle first showing a point of light, which in a moment spreads to the circumference, and increases in intensity till it blazes with a lustre almost dazzling. The colour of the thoracic light is a rich yellow-green. In a dark room, *pitch-dark,* this insect gives so much illumination as to cast a definite shadow of any object on the opposite wall, and when held two inches from a book the whole line may be read *without moving it.* The under part of the thorax has a singular appearance when the tubercles are fully lighted up; for the horny coat of skin being somewhat pellucid,

displays the light within redly and dimly, as if the whole thorax were red-hot, particularly at the edges, immediately beneath the tubercles. When left alone, the insect soon relapses into stillness, and the tubercles soon fade into darkness, either total, or redeemed only by a spark scarcely perceptible.

I had been familiar with this firefly for some weeks, and had made the above observations on it, without being aware that it possessed any other source of light than the thoracic tubercles. I had indeed remarked that when flying at liberty the light which it diffused was of *a rich ruddy glow*, and yet these individual insects, if captured and held in the hand, showed only *green* light. I much wondered at this, but knew not how to account for it, until a friend explained it, illustrating his remarks by experiment. On the *ventral surface*, when the abdomen is extended, there is seen, between its first segment and the metathorax, an oval transverse space, covered with thin membrane, which glows with orange-coloured light; totally concealed however when the abdomen is relaxed, by the overlapping of the metathorax. When the insect is placed on its back it throws itself into the air like other *Elaters*; but if it be made to repeat this many times it appears to become weary, and endeavours to raise itself by bending the head and the abdomen back, so as to rest on the extremities, in hope to *roll* over. It is when thus recurved that the abdominal light suddenly appears, the oval space being uncovered. When held in the hand, the same effect is produced by forcibly bending back the abdomen with the fingers; but this is not very easy of accomplishment, on account of the resistance of the closed elytra; but if these be held open with one hand and the abdomen recurved with the other, it is readily shown. As the open space, then, can be exposed only when the elytra are expanded, the reason is manifest why the red light is never displayed by the insect when walking or resting: the green thoracic light on the other hand *may* be displayed at any time; it is however very rarely shown during flight. On one occasion two or three fireflies, having entered the sitting-room in the evening, gave out the red light most brilliantly as they flew round near the ceiling, the spectators being beneath them; one of these, being alarmed by my efforts to capture it, gave out the thoracic light also very brightly; and the mingling of the green and red light in the evolutions of flight produced an effect indescribably beautiful.

That the thoracic light is subject to the will of the insect is indubitable; but whether the same can be predicated of the abdominal light I am not assured. During flight it is every second intermitted, as far as the observer can detect; but its appearance or disappearance may depend upon whether the dorsal or ventral surface is presented to the eye. This is when, soon after dark,

the insect is sweeping in rapid, headlong, irregular curves over the fields or along the edges of the forests; when the appearance resembles that of a stick with the end on fire (but not in flame) carried or whirled along by one running swiftly, quenched suddenly after a course of a dozen yards, to appear again at a similar distance. When slowly flying over the grass, the progress of one may often be traced by the red glare on the ground beneath; a space of about a yard square being brightly illuminated, when no light at all reaches the spectator's eye from the body of the insect.

Whether any light would appear pervading the abdomen if the segments were stretched, I cannot positively say, for I have not in my journal any note on this point. I think not, however; for in my repeated handlings of these insects and experiments on their abdomens, I could scarcely have avoided extending the segments, even unintentionally; but I am quite certain I never saw any light except in the one ventral and the two thoracic spots. If one be trodden on, a mass of mixed light remains for some minutes among the fragments. The story told by Peter Martyr of these *Elaters* having been hunted for, to eat the mosquitoes is sufficiently amusing; of course it is not right to *contradict* a statement because one has never verified it, but I may be permitted to observe that I utterly disbelieve it. That they might afford a substitute for candles in performing household operations that required no great exactness, is certainly true, provided they were constantly carried in the fingers; but if put under a glass, or allowed liberty in a room, as I have abundantly proved, they very quickly conceal their light. I have found too, that one kept beneath a glass would display very little light the next evening, even under the excitement of being handled, and on the following night would be irrecoverably dark: this may have resulted from the lack of food or of exercise, not I think from the lack of air or of moisture.

About the middle of May a larva of an Elateridous beetle was brought to me which was luminous; in the dark the whole insect was pellucid, but the divisions of the segments showed distinct light, blue and pale, not very vivid. It was impatient of being handled, and bit fiercely at the hand, but ineffectually. I suspect that it was the larva of this firefly: the specimen is now in the British Museum.

33. *Agrypnus* (sp. nov.). A single specimen occurred; taken on the 4th of June at Sabito.

34. *Ectinus* (sp. nov.). Taken at Belmont early in June.

35. *Limonius* ? (sp. nov.). Hampstead Road, late in June.

36 to 38. *Sphærocephalus* (three species, minute).

[To be continued.]

XXIII.—*On the* Ventriculidæ *of the Chalk; their classification.* By J. Toulmin Smith, Esq.

[Continued from p. 48.]

Descriptions of species.

Family Ventriculidæ.

Character. Structure. Polypidom membranous: membrane composed internally of fibres arranged in several—usually five*—layers of cubic squares, equal, for the most part, in the plane of thickness and of superficies, and connected at all their angles by other fibres having a regular octahedral arrangement: exterior to this, both within and without, a dermis composed of a single layer of smaller squares, and in which the polyps are lodged, usually on both surfaces: exterior to this a simple epidermis: roots distinct, less regular in structure and without octahedral fibre.

Habit. One or more central cavity, the principal opening to which is at the top: roots ensheathing base of polypidom and extending below into radicles; never affixed to solid bodies.

The details which have been already given render further observations on the characters of the family unnecessary.

Genus Ventriculites.

Character. Pouch-shaped; varying greatly in size and dilatation: cavity single and regular: membrane forming the wall of the cavity either simple and smooth on both surfaces or more or less closely and regularly folded (thus giving it a rugose character): margin of wall thinned or rounded off to an edge: polypiferous on both external and internal surface.

The structure of all the Ventriculidæ is obviously designed for the purpose of securing permanence of form, and thus safety and free access of water to all the individual polyps. This object is effected by two means: first by the very remarkable structure of the membrane already described; secondly, by the regular, often nearly hemispherical figure which the whole body assumes.

Specimens of *Ventriculites* are found of all sizes, and it can easily be understood that, from the earliest period of their development, the same, general form is assumed, which, as they increase and spread, is still retained. Thus the question of their growth

* I believe it to be always five; but the difficulty which exists, from the causes already named, in ascertaining these minute points in all individual instances induces me thus to qualify the generality of this character.

seems to involve fewer difficulties than, at first sight, strike the observer in respect to the other genera.

The access of sea-water was well secured in this genus, inasmuch as, though the folds of some species are close, the expansion of the whole mass and relative size of the central cavity are usually greater than in any other genus, thus compensating for the frequently looser nature of the fold in the other genera. It may perhaps be inferred that the ocean in which this genus dwelt was subject to such modifications that its waters were less liable to disturbance than those of the ocean in which *Cephalites* and *Brachiolites* originated; so that a larger size could be attained in safety, and with less multiplied provision for security against such disturbances.

The whole genus *Ventriculites* is characteristic of the upper chalk. I have a few specimens which may possibly have come from the middle chalk*; but every such case is doubtful, while I have carefully ascertained that the mass are certainly from the upper chalk.

§ *a. Simplices.*

Inner and outer surfaces corresponding.

1. *Ventriculites simplex.* Pl. VIII. (vol. xx.) fig. 1†.

Membrane simple and without trace of fold: moveable processes minute or absent.

This is the type of the whole family, and it is a most happy circumstance that it exists. That existence at once destroys all the theories as to the anatomy and physiology of this group of fossils which have been suggested from examination of some special forms only; while it affords the means of demonstrating some important points. It appears to be a rare species, as, though I am fortunate in having myself obtained a very perfect series, I have certainly never seen half a dozen specimens out of my own cabinet.

When the underskin and polyp-skin are absent, as most often happens, the surface, if uninjured, is particularly beautiful. It exhibits, over its whole surface, with the utmost regularity, that square arrangement of fibre, with the subtending octahedra, already described. When the underskin is present without the polyp-skin the squares are not seen, but the whole surface is covered

* See Ann. and Mag. Nat. Hist. vol. xx. p. 337.

† It is not possible to give illustrations, in this work, of all specimens of full size, several of them often exceeding in diameter the size of the page. It will be understood, therefore, that all the specimens of the present genus figured on Pl. XIII., with the exception of fig. 9, are of specimens below the usual size.

with a much smaller-meshed tissue which appears dotted all over, the dots being the polyp-cells. When the polyp-skin is present it hides each of these appearances, and is marked only with slight depressions in the places where the dots are seen under the conditions last named.

The traces of the moveable processes appear slight, often quite wanting, in this species. This is what might be expected if the object of those processes was to sweep the surface clear of obstructions from the mouths of the cells. The surface being plain, such obstructions would be far less liable to accumulate around it than near those rugose surfaces which other species present, and on the most rugose of which the processes are most strongly marked.

I have specimens varying from 7 inches to 1 inch in diameter.

It appears to me that the fossil called by Dr. Mantell *Spongus Townshendi* (South Downs, p. 164) is nothing more than a *V. simplex,* in flint.

2. *Ventriculites impressus.* Pl. VIII. (vol. xx.) figs. 2 & 3*.

Membrane more or less slightly folded at upper part, but generally without regular figure: moveable processes frequently conspicuous.

The basal portion of this species is usually plain like *V. simplex,* but it soon exhibits marks of fold. These are sometimes slight, sometimes deeper. They vary much in different specimens, so that it might be thought advisable to distinguish varieties. It has seemed to me, however, better to include all under one name only. They may be generally known at once by the basal portion being quite plain as in *V. simplex*; by the much less depth of the folds than in the next species; by the depressions being usually more or less oval instead of round; and by the want of any regular figure in the arrangement of the folds.

This being the first species in which the membrane is folded, it will be well to consider the principle, if any, upon which the fold in all the Ventriculidæ is arranged; and also to inquire whether the polyps existed, during the life of the animal, over the inner parts of all the folds.

To treat of the latter question first: I have already intimated that, as a general rule,—exceptions may, as in *Eschara* and *Flus-*

* The object of fig. 2 is to illustrate the very deceptive appearances which the difference in the state of perfection of the fossils will occasion. On the lower part of that figure all remains of the actual body are lost. On the upper part an *Ostrea* is seen, and, near it, a small part of the actual body remains. The difference between this and the rest of the figure must be very apparent.

tra, be found to this general rule,—both external and internal surfaces of the Ventriculidæ were polypiferous. And notwithstanding the closeness of the folds in many species, I believe that the inner parts of all the folds were polypiferous also. The inquirer familiar with recent Polyzoa will find no difficulty in realizing this as true, as he will be aware that these minute creatures are often packed in spaces so close, that it would seem to be, and perhaps is, impossible that all should be protruded at the same time. This fact has attracted the attention of all observers. Dr. Farre notices that the individuals of *Halodactylus diaphanus* "are so closely set that there seems to be hardly room for their several operations;" and that, on this account, it is often "scarcely possible to make any observations upon them" even with the microscope*. And the most recent writer on the Polyzoa, Sir J. G. Dalyell, in his 'Remarkable Animals of Scotland,' calls attention several times to the extreme complexity of the mass and to the difficulty of even microscopic observation on that account †. And in the plates of both these writers (pl. 25. fig. 1, Farre; pls. 43, 44 A, &c. Dalyell) the same fact is well shown. It thus becomes obvious that, in recent allied forms, individuals are packed in positions quite as close as, if not closer than, in any of the Ventriculidæ, and in positions apparently more hazardous to the free action of the individuals themselves, inasmuch as the form of the recent species specially referred to is less fixed and unyielding than, from the very nature of their structure, the Ventriculidæ have been shown to have necessarily been.

Having thus shown that there is no improbability that in fossil forms the surface should have been thus closely covered, in all its parts, by the polyps, I will add, that the results of positive observation establish the fact that the inner parts of the folds in the Ventriculidæ were thus polypiferous. I have carefully dissected several folds in specimens, both in chalk and flint, in which the fold is the closest of any species, and I have found, by aid of the microscope, the presence of the polyp-cells clearly and unequivocally marked.

With respect to the arrangement of the fold, the elaborate dissection of many individuals of more than thirty different forms of Ventriculidæ has fully satisfied me that here, as elsewhere, UNITY is prevalent; and that the fold of the membrane forming the wall of the pouch is not capricious and without method or principle, as at first sight it might appear. I have fully satisfied myself that every form and variety of fold ‡ which different

* As before, p. 405.

† See, *inter alia*, pp. 233, 234, as to *Cellularia loriculata*.

‡ It is necessary to distinguish the folding of the membrane forming the

species of Ventriculidæ exhibit is based on a modification of the simple *plait*. Unimportant as the question may, at first sight, appear, it is in reality of much importance. Every illustration of the Law of Unity is, and ever must be, interesting to the student of natural history, and important as the surest indication that some point of truth has been attained. And without the guide of some simple unity of this nature, it would be quite impossible to make the structure of the different species of Ventriculidæ understood by the inquirer. The multiplied dissections which I have made is a labour which few would have the inclination, and as few the opportunity, to undergo.

In the present genus and section we shall meet with one species in which the form of the simple plait is found without any modification. In the present species, and in several others, the primitive plait is not so obvious; but the comparison of several specimens, and especially, as is so often the case in the illustration of a Law of Morphology, of particular instances assuming a somewhat abnormal character, will enable the careful observer to trace, even in these species, this primitive plait. The limits within which I am necessarily restricted prevent me from entering more fully into, and illustrating at greater length, this question, —which I certainly regard as one of very much interest and importance. In the present section of the genus *Ventriculites*, in which every depression of one side answers to an entirely or nearly corresponding depression on the other, the existence of the plait is less material to the understanding of the character of the wall of the pouch than where the fold assumes that complexity which it does in the section *Complicati*. I shall dwell only slightly upon the point, therefore, in describing individuals of the present section, leaving the fuller illustration of it to those specimens from which the illustrations of Pl. XIII. figs. 13, 14 and 15 are drawn, and which will I hope satisfy every careful and candid inquirer that the most apparently differing external forms may depend on the different modifications which the upper and lower fold of a simple plaited membrane may undergo.

3. *Ventriculites quincuncialis*. Pl. VII. (vol. xx.) fig. 7, and Pl. XIII. fig. 11.

Membrane deeply folded, usually from base to margin, of nearly equal width the whole depth of the fold, and in regular quin-

wall of the pouch, where the whole body is a single pouch, from the subdivision of the body itself into distinct *lobes or branches* as found in *Brachiolites*. It will presently be seen that the wall of these lobes and branches is marked by the same characters as the wall of the single-pouch forms now under more immediate consideration.

cuncial figure: moveable processes conspicuous: wall often thick.

In this, as in the former species, must be included forms which, at first sight, vary to a considerable extent, but which I conceive to mark either distinct varieties or distinct ages. It is however almost impossible, in specimens in a good state of preservation, to mistake the species, the characteristic type of fold being found in all with little variation. The wall is usually much thicker than in *V. impressus*, and the fold begins from the base. In some specimens the fold is so deep that a thickness of nearly two lines,—sometimes even more*,—is attained in the wall of the pouch. The folds are almost equally broad down their whole depth, so that in this species the general aspect, both external and internal, is level, contrary to what takes place in *V. muricatus*, and which difference will best be understood by comparing figs. 11 and 12 of Pl. XIII. which represent sections of these two species†.

It occasionally happens that the outer surface is not quite so regularly marked as the inner, though still each depression on one side is accompanied by a corresponding elevation on the other. This variance is probably owing to some circumstance connected with the process of the fossilization of the individual. Hence even a partial angularity in the margin of the folds is, in some such specimens, seen on the outer surface of the wall of the pouch. Such specimens appear to have been partly crushed before or during fossilization. The inside preserves all the usual regularity of the fold.

It occasionally, though rarely, happens that the quincuncial figure is not maintained; in all specimens there must necessarily be places where it is not truly kept, owing to the mode of increase of the animal from base to margin.

The so-called *Ocellariæ*, so often mentioned, belong to this species. What are thus named are either young specimens, or the lower parts of full-sized ones. These are usually nearly cylindrical at the upper part and taper very gradually to the base; or form, altogether, a very acutely pointed inverted cone.

There is no species which affords more entire disproof of the contractile theory than this. It is obviously impossible that any membrane should contract in the way in which this form exists,—and with no variation whether forming a close cylinder or an almost flat disc.

I am well-aware that this is the species to which appeal will always be made in opposition to the views which have been stated

* I have an instance in which the thickness of the wall exceeds a quarter of an inch.

† In the specimen figured on Pl. VII. vol. xx. fig. 7. the folds are unusually narrow, but the quincuncial character is well-displayed.

as to the fold of the membrane. It will often be triumphantly referred to as affording evidence of perforation. There may be no *primâ facie* reason why the Ventriculidæ should not, like the recent *Retepora,* have been perforated. When however it is found, through a vast number of differing forms, that one plan, that of the folded membrane, has been unquestionably adopted; and when it is found that in no other case in which Ventriculitic structure is present is a thickness of more than five of the solid squares attained by any part of the fold which forms the wall of the pouch, while it is found that, in this species, the thickness of the entire wall *varies* from one line to three lines,—thus exhibiting, if the actual wall be but a perforated mass, the extraordinary and, upon every principle, anomalous fact of there being no *constancy** in the structure of the central polypidom; there is certainly every reason to conclude that Unity is not violated in this case, and that, like others of the family, this is truly a folded and not a perforated membrane. The various deceptive appearances which the mere fossil may put on have been already more than once remarked. In the examination of the present species, above all, the greatest skill and care are necessary, because it is obvious that the very depth and narrowness of the fold must, if any abrasion or injury of the external surface† take place, destroy the traces of the membrane covering the top of each depression, and because the small size of the depressions and elevations renders it very difficult to follow the fold which forms them from one surface to the other. Feeling therefore to the fullest extent the difficulty of ascertaining the actual *fact* in this case, and at the same time the importance of ascertaining that fact, both as an exception, if it should prove such, to the Law of Unity, and as a determination of a point in palæontology which has been now mooted for more than thirty years, I carefully dissected numerous specimens, both in flint and in chalk, and both with the slitting-wheel and the needle, and followed up and down the so-called (sometimes) cells or (sometimes) perforations to their terminations. The clear and unequivocal result has been that the so-called *Ocellaria* is no anomaly: that the Law of Unity has not its exception here; that this is a true case of fold of membrane: finally, that I have at this moment before me specimens in which

* It will be obvious to the careful inquirer that there is nothing anomalous in the varying depth of the folds, inasmuch as, in all species, that depth will naturally be dependent, more or less, on the age of the individual.

† In every instance, both in chalk and flint, with very rare exceptions, some of the body adheres to the matrix. In the present species, where the bases of the folds are so small, it will necessarily, therefore, often happen that just those bases adhere to the matrix. Hence alone will result an apparent perforation of the wall, the remains of the membrane not being present, and not therefore traceable, over those bases.

I can as clearly see the fold in and out of that membrane as it is seen in fig. 11. Pl. XIII. I wish to be specific and precise on this point because I know that a bare description will be questioned. I am obliged to state that such a reality as is represented "magnified" on p. 279. fig. 2 *b* of Dr. Mantell's 'Medals of Creation' never had existence * in the nature of the animal of which fig. 2 gives a view of the natural size of the fossilized remains.

In the museum of the Yorkshire Philosophical Institution there is a fragment of a specimen of this species almost discoidal, which still measures more than nine inches across, and, when entire, must have been of still greater size. This is an unusually large size for the species to attain, but the variation in that respect is very great. There is another interesting specimen of this species in that museum in which the whole body has become converted into chalcedony. The outer surface is nearly entire, as is also a considerable part of the inside. The structure is, as usual in solidified chalcedonic specimens †, obliterated throughout the greater part, but it can, in places, be still clearly traced. The individual underwent pressure before or during the process of fossilization, and also some decomposition, so that the external character has become somewhat modified, and it is only in parts that the internal arrangement can, at places of section, be seen. The peculiar state of the specimen,—solidly chalcedonic without the presence of any true flint,—renders it however very interesting ‡.

4. *Ventriculites muricatus*. Pl. XIII. figs. 1 & 12.

Membrane deeply folded, without regular figure: folds unequal in width throughout their depth: moveable processes often conspicuous: wall of moderate thickness.

The point wherein this species differs most essentially from the last will be at once understood by comparing figs. 11 & 12 of Pl. XIII. It has been already explained that, through the uniformity in the breadth of the fold, the general surface of *V. quin-*

* And see p. 280: the polyparium of this species is no more "calcareous" than that of any other of the Ventriculidæ. Treated with acid it is acted on in precisely the same way and to the same extent as are all specimens of Ventriculides preserved in flint, and leaves an exquisitely delicate cast of the body of the animal and of the structure of its polypidom.

† See before, p. 85. vol. xx.

‡ It has already been stated (vol. xx. p. 86), that "*in general* when any part of the soft substance of a body encased in chalk decomposed, its place was soon filled up with particles of chalk." The above instance is one of the rare exceptions to this general fact; and the peculiar condition of the Yorkshire chalk (which is much more compact than that of Kent, &c.) may lead us to expect more numerous instances of these exceptions from that region than from the chalk of the south-east of England.

cuncialis is smooth. It will be perceived that where, as in fig. 12, the folds are broad on each surface at their margin and narrow to a point at their base, the effect must be to give to the whole wall of the pouch a rough surface. The wall is usually not very thick. I have never seen it attain so great a thickness as *V. quincuncialis* often does. The height and depth of the folds render it difficult ever to confound it with *V. impressus*, in which also the same smooth general appearance of the surface as in *V. quincuncialis* is usually maintained, and for the same reason as in that species.

5. *Ventriculites tessellatus.* Pl. XIII. figs. 2, 3, 4.

Membrane folded in regular quadrilateral and rectangular figures usually more or less oblong: wall of moderate thickness.

In Mr. Morris's Catalogue mention is made of a *Ventriculites quadratus*, and reference is made to Goldfuss, pl. 33. fig. 1. I have already* stated that this is no Ventriculite. The description is, "*seriebus pororum oblongorum rectis parallelis decussantibus*," —an error into which I cannot conceive it possible that Goldfuss could have fallen if he really had the present species before him. And the magnified sketch given in fig. 1 *b* of the same plate,— unless fancy and not actual observation be there copied,—differs as widely from any characters of the present species, and from any form of Ventriculitic structure, as does the description which has been cited.

This form is rare; and it is still rarer to find a perfect specimen. I have several fragments, excellently well displaying structure and fold, and during the summer of 1847 I was fortunate enough to find a perfect specimen, with roots and margin, and both body and cast, entirely perfect, and five inches in diameter; but I was so unfortunate as for it to break in pieces before I could convey it home, a danger to which the collector of these delicate fossils is peculiarly liable. Though this loss is not easily to be replaced, the opportunity of verifying the entire form of the species was important. The rarity of the species has prevented me from making sufficiently extended observations on the moveable processes to state, with confidence, anything definite in regard to them.

In this species the plaits may often readily be traced, with the oblong depressions running along them on each face of the wall. This being borne in mind, the figures often displayed on section will readily be understood, when, instead of the regular alternation of depressions seen at one place of section, as in fig. 4

* Ante, vol. xx. p. 78.

(Pl. XIII.), the character represented in fig. 3 will, at another place of section, be seen.

6. *Ventriculites cavatus.* Pl. XIII. fig. 5.

Membrane folded in concavities of considerable breadth, rarely regular in disposition: wall of moderate thickness: moveable processes often well-seen.

This species can never be confounded with the last. The shape of the fold, its sloping edges, and the want, in general, of regular figure, at once distinguish it. A linear arrangement of the depressions is often traceable, marking the places of the primitive plait.

This species might readily be divided into two or three varieties, marked by the fewness or abundance, the small or large size, and the greater or less degree of regularity, of the folds. The principle of the fold,—which in all cases is the groundwork of the present classification,—appears however to be the same in all these cases, and they may, not improbably, be but modifications indicative of a difference of age. The concavities are usually somewhat elongated in specimens of which the pouch is closely cylindrical.

In this case, as in all others, it is necessary that both sides, or a good section, of the specimen should be examined, as *V. radiatus* will be found to be marked on the inner surface by characters bearing some superficial resemblance to those distinguishing both surfaces of the present species, while *V. bicomplicatus* bears, both on the external and internal surfaces, characters which may sometimes mislead the observer. A section of the present species however will show the wall much thinner and the cavities shallower than in either of those species, while, in well-preserved specimens, the entirely different character of the fold cannot fail to be seen.

7. *Ventriculites striatus.* Pl. XIII. figs. 6 & 13.

Membrane folded from base to margin in regular close and simple plaits: processes very conspicuous: wall of moderate thickness.

This is an exceedingly interesting and very marked species. The plaits, which have heretofore been traceable only by careful comparison and an effort of induction, become in this species the one characteristic feature. Not a trace is present, on either surface, of the "tubuli"—assumed to be polyp-cells or absorbents—of Dr. Mantell, and the presence of which is expressly stated by him to be characteristic of the genus and species*; upon the assumption of which indeed all his views and descriptions have

* See ante, vol. xx. p. 77.

been based. The inquirer will be well-prepared for this entire absence of any such tubuli from its having been seen that, in the preceding species, the depressions (which alone are what could, even on a superficial observation, be called tubuli) have the greatest diversity of form and character, a diversity which at once negatives their being of the nature assigned to them by Dr. Mantell. It has moreover been seen that, as a matter of fact, they are in no instance tubuli, but that they can, on the contrary, be traced as folds of the membrane forming the polypidom itself.

On the other hand, the present is the only species which could seem to lend any support to the contractile theory. The observer however who has studied the several preceding species will probably ask for no proof that the present does not stand out as an anomaly and an exception from them all. If he need such, he may be referred to the observations already made *, generally, on the matter. These have full application in this as in every other case, and sufficiently show that this species offers no violation to that Unity which prevails through every branch of the present inquiry.

Different specimens vary in the size and depth of the plait. It is suggestive, perhaps, as before, of difference of age. It is where the plait is deepest and broadest that the moveable processes become most conspicuous.

The plaits are not narrow at the base and of increasing size as they approach the margin. They maintain the same size from base to margin, and the increase of surface is effected by the increase in number of plaits as the margin is approached; an increase effected by the division, from time to time, of one plait into two,—each of equal size with the original one,—a mode of increase which generally prevails in all species in which the plait can be distinctly followed. The species is not common.

§ *b. Complicati.*

Inner and outer surfaces not corresponding.

1. *Ventriculites mammillaris.* Pl. XIII. figs. 7 & 14.

Inner plaits simple and regular: outer plaits raised in large hollow bosses at regular intervals: processes very conspicuous: thickness of wall considerable.

This is the first instance in which we find the direction of the fold changed between the external and internal surfaces. There is no species more strongly marked, and none which affords a better illustration of the value and importance of a principle of Unity as the essential and most valuable means to true scientific

* Ante, vol. xx. p. 89.

research. The fact of the mammillated external appearance of this species is easily seen and as easily recorded: so is also the fact of the striated internal appearance. But it would be difficult, by any description, to make it clearly understood how such apparently contradictory appearances could result from the folding of a simple membrane*, until it had been ascertained, by careful and multiplied dissections, that this and all other characters of the fold of the membrane forming the wall of the pouch are grounded upon one single and simple unity of plan of which all present clear and intelligible modifications.

On the outside of this species as usually seen in a fossil state, and as it must usually have appeared in a recent state, no mark of the plait is seen. Large rounded elevations scattered, at first sight irregularly, over the whole surface, are all that meet the eye. If however the reader will carefully consider figs. 13 and 14 of Pl. XIII. he will see, in fig. 13, the simple plaits, regular and uninterrupted, within and without, as in *V. striatus*; while in fig. 14 he will see that the perfect plait is still present, and that the *inner* surface [the lower part of the figure] is still simple and uninterrupted, but that the *outer* plaits are interrupted along their whole length by rounded elevations,—not solid, but hollow,—elevations of the membrane into those shapes instead of the plait being plain and simple. These figures are somewhat exaggerated in size in order that the principle may be more clearly understood.

It will be found that in each of the forms which follow, and

* As the extraordinary complications in the fold of the membrane of many species were gradually developed by multiplied dissections, I long despaired of being able, by any descriptions, to make them understood. When by degrees the unity of plan which I have endeavoured to indicate above, as the groundwork of all that complexity, opened upon me, I felt an important key to have been obtained, which experiment proved to be applicable to every case. I indulge some hope that the development of this unity may be of a utility beyond the mere understanding of the forms now under discussion—however interesting those may be to myself and others. In the descriptions of numerous tissues in human and other branches of anatomy, I have often myself felt the want of some clear and simple basis of unity in the descriptions attempted of those tissues; which want has caused them to be often unintelligible. Any pains which the investigation of the present subject may have cost will be more than rewarded if the suggestion of an unfailing unity in the arrangement of all complex tissues shall be felt to be (as I cannot doubt that it is) generally applicable. It seems to me, that as, by application of this principle, forms varying so entirely as it will be found that many of the Ventriculidæ do in mere general external characters, and therefore heretofore classed in entirely different natural groups, are now demonstrated to belong to one group, so the application of the like principle may, in many points of anatomy, lead to the discovery of intimate relations, not now suspected, between tissues which appear very different in structure.

which appear so widely different from each other in all that meets the eye of the general observer, the characters which each exhibits may be as readily understood as in the present species by taking as the basis that simple Unity of plan which has been thus illustrated.

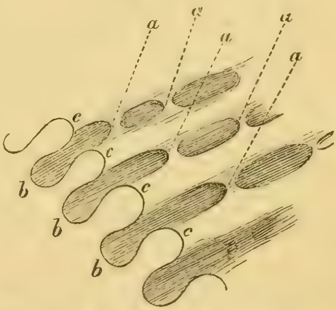
2. *Ventriculites latiplicatus.*

Folds very broad and deep: outer plaits simple and regular: inner plaits inclining, at intervals, towards, and anastomosing, a little below the surface, with, adjoining plaits: wall very thick.

This is a very interesting species. It presents us with the first instance of the plaits departing from their entire individuality, and of a connexion being formed between adjoining ones. In the present species that connexion is merely by a slight anastomosis at distant intervals. There being no depression in the plait, on either surface, the access of water is perfectly preserved without any additional provision such as we shall find in *V. radiatus* and many others.

In *V. mammillaris* the departure from the simple plait took place on the outside. In the present species it takes place on the inside, and is more marked in its character and degree; but it is none the less an illustration of the principle of Unity which it has been endeavoured to explain, being clearly but a modification of the simple plait. This will be understood from the following figure, in which *b, b, b* are the lower plaits; *c, c, c,* the upper plaits; and *a, a, a,* the points of anastomosis. We shall, in the next species, find the complexity of the fold much increased.

Fig. D.



The wall of this species is thicker than that of any other species of the genus *Ventriculites.*

3. *Ventriculites decurrens.* Pl. XIII. fig. 8.

Plaits often irregular in direction: outer plaits constricted at distant and unequal intervals: inner plaits depressed at short and nearly equal intervals; bulging on each side around depressions till adjoining plaits meet and open into each other: processes conspicuous: wall of moderate thickness.

Var. *tenuiplicatus.* Pl. XIII. fig. 9.

Plaits close and delicate: outer plaits nearly regular in direction

from base to margin with slight occasional constrictions: inner plaits depressed at regular intervals; bulging on each side around depressions till adjoining plaits meet and open into each other: processes conspicuous: pouch very often nearly cylindrical: wall thin.

Marked specimens of these two varieties are very distinguishable, but, upon the principles to which I have confined myself in discriminating species, I do not think it proper to separate them; the elements of the modification of the fold being similar in each variety. Specimens in which the two varieties run into each other are not unfrequently found.

The variety *tenuiplicatus* is a most beautiful and delicate fossil. I have several specimens on which the polyp-cells are finely seen.

In examining each of these varieties the importance of the clue afforded by the principle already explained of Unity in the fold of the membrane becomes strongly felt. Let the reader compare figs. 13, 14 and 15 of Pl. XIII., always remembering that fig. 13 is the basis of every modification. In fig. 15 he will see the *lower* plait [it is immaterial for the present purpose whether that is to be looked at as the inner or outer surface] retaining its simplicity, while along the top of the upper plait he will see a series of circular depressions at short and equal intervals. At the sides of these depressions the membrane bulges out,—in order to preserve the walls of the plait below the depression clear from contact*,—until the bulgings on the two adjoining plaits meet and anastomose. These then open into each other in the centre of the place of anastomosis, leaving, however, below them and on each side a clear space; so that strength and security are gained to the whole mass, and, consequently, the safety of the individual

* This is but one other among the numberless beautiful illustrations afforded by the anatomy of the Ventriculidæ of obvious design and adaptation. Did these walls touch, there would be a great loss of surface and little or no additional strength. By the actual arrangement there is a vast gain of both surface and strength, as well as an additional security for free access of sea-water to all parts of the inner surface. It has already been seen that this additional provision not being needed in *V. latiplicatus* is not found in that species. It is proper to add, that the fact that, around the depressions, the adjoining plaits do not only anastomose but *open into each other* has been ascertained by most careful examination and dissection of specimens in chalk and in flint; but that, having clearly ascertained the fact in instances where there is thus such an obvious purpose for such an arrangement, I cannot doubt that, under similar circumstances of structure in adjoining parts, such is always the arrangement of the fold in this particular, though the minuteness of the parts generally prevents the possibility of clearly distinguishing it in chalk specimens. The place of the opening does not usually exceed, in the necessarily somewhat collapsed state in which it is exhibited in the fossil condition, the 40th of an inch in diameter, a space which the iron stain in the chalk is more than sufficient to obliterate.

polyps is ensured, together with a great increase of polypiferous surface.

I am aware of no instance among the Ventriculidæ in which a mere ridge or flap of membrane is added on,—as this would practically be if the membrane forming the sides of these depressions came in contact with that forming the sides of the plaits. There are, on the other hand, very many cases in which, as in the present species, additional strength to the whole mass is afforded by a means which gives a very great additional surface for the development and security of that life, the manifestation and multiplied means of enjoyment of which were the end of the existence of the whole creature.

On each side of the places where these meeting bulgings blend, the vacant spaces between the plaits put on, naturally, from the shortness and regularity of the distance between the bulgings, a circular form. As one of these must, of course, lie between each double pair of the depressions, a quincuncial figure is thus assumed by the whole (see the darker spots in fig. 15 of Pl. XIII.). The inquirer will thus at once understand the appearance presented by the inner surface of many species of Ventriculidæ. He will clearly see that the "tubuli" of Dr. Mantell are things without existence. He will understand that though, at the surface of a fossil of which all the interstices are filled with chalk, all the circular marks appear alike, yet the dissection of alternate rows of them will reveal very different conditions; one row consisting of more or less shallow (in the present species usually rather shallow) and closed depressions; the other having no true depressions at all, but consisting of cavities extending to the bottom of the intermediate plait, and indeed, before and behind, underneath the intermediate bulgings, running into and forming part of the longitudinal cavity of that plait.

The wall of the variety *tenuiplicatus* being usually thin, the depressions on the inner plaits, though shallow, are sometimes to be seen through on the outside, if the specimen has come very clean out of the chalk. It is very rarely, however, that specimens can be got out of the chalk in this clean manner, portions of the matrix usually filling up the spaces between the plaits. In the recent state, and when, instead of being in the collapsed condition in which we find the fossils, the animals were alive and fully distended with all their fluids*, no doubt the lower surface of all the depressions on the top of the inner plaits could be seen from the outside. The living creature must have appeared as composed of a number of plaits which, on their inner surfaces,

* Every reader must perceive the difference between the comparative states of *collapsion and distension* and those of *contraction and expansion*.

exhibited numerous shallow depressions; and which plaits, on each side of these depressions, were united together by small transverse tubules, the mouths of which tubules were directed towards the *outer* surface of the whole body, and opened, always, into the interspaces between the outer plaits.

It will be obvious that sections, whether made longitudinally or transversely to the plaits, will vary in numberless ways in the figure which will be seen, according to the particular point of the plait through which the section passes. This must be remembered when the section seen at the edge of a flint or fractured chalk specimen is examined. This observation applies as well to the present species as to almost every other which will subsequently come under notice.

The plaits of *V. decurrens* are not very regular in their course. On the contrary, the outer plait, where the course is easily traced, is often very winding, though several generally run parallel to each other. The constrictions occur at irregular and distant intervals, and cause the surface to appear as if several of the round elevations of *V. mammillaris* had run together down the surface, —a modification which may truly be considered to represent the fact. Hence the specific name. The constrictions do not extend the whole depth of the plait. They do not appear ever to extend so deep as to interfere with the mode of fold characteristic of the inner surface. It is owing to the winding course of the plaits in this species that the rings seen on the inside do not assume, as in *V. radiatus*, a perfectly regular quincuncial figure; the places of the depressions and accompanying characters of structure varying, of course, in places, as the plait winds. In *V. tenuiplicatus*, where the plaits are more regular, the quincuncial figure on the inside is correspondingly more regular. The constrictions on the outer plaits of that variety are much slighter than in *V. decurrens*. They resemble much more a very slight exhibition of the normal characters of *V. mammillaris*. They thus rarely interfere with the continuous course of the plait.

4. *Ventriculites radiatus*. Pl. XIII. figs. 10, 15.

Plaits broad and deep: outer plaits regular, and with an occasional lateral connection: inner plaits deeply depressed at short and equal intervals; bulging on each side around depressions till the adjoining plaits meet and open into each other: processes very conspicuous: wall thick.

I have retained for this interesting species the name *radiatus* of Mantell, as being the species which comes nearest in superficial external and internal appearance to his descriptions already cited*.

* Ante, vol. xx. p. 76.

This species unites the characters observed in *V. latiplicatus* and *V. decurrens*. In the former mere points of connection exist, on one surface, between the plaits; in the latter the remarkable depressions, bulgings and openings into each other last described exist, also on one surface only. In the present species the latter characters are found on the inside, the depressions being, however, deeper than in *V. decurrens*; while, the plaits being deep, they exhibit, on the outside, and at distant intervals, points of mere connection (no depressions being present on that surface) as in *V. latiplicatus*.

The difference between the constrictions which mark the outer plaits of *V. decurrens*, and the points of connection, without any constriction, which exist between the outer plaits of the present species, is alone sufficient to distinguish the two. In addition to this, however, the present species is much thicker and more massive than *V. decurrens*; it often attains a thickness in the wall of the pouch nearly as great as *V. latiplicatus*. The regularity in the direction of the plaits is another distinguishing character.

Owing to the regularity of the plaits in this species, the figure assumed by the inner folds is very regularly quincuncial.

The inquirer must be careful not to be misled by inspection of an inner surface only into determination of this species, as such surface in either *V. cavatus* or *V. bicomplicatus*, especially the latter, and sometimes in *V. decurrens*, will be difficult to distinguish. It cannot be too often insisted on that parts of both surfaces, as well as sections, should be examined before determining species with certainty.

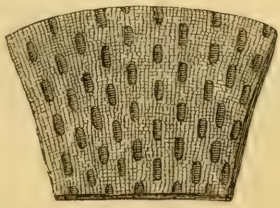
This species is very local in its distribution, being very rare in many places.

5. *Ventriculites bicomplicatus.*

Plaits broad and deep: both outer and inner plaits deeply depressed at short and equal intervals, which alternate in adjoining inner and outer plaits; bulging on each side around depressions till adjoining plaits open into each other: processes very conspicuous: wall very thick.

In the present species we meet with a much greater complexity of fold than in any preceding one. The plaits on both surfaces undergo a marked modification which resembles the modification seen on the inner plaits of *V. radiatus*. The form of the depressions on the external surface are, however, generally oval instead of round, as in fig. E.

Fig. E.



The descriptions which have been given of the mode of fold on the inner surface of *V. decurrens* and *V. radiatus* render it unnecessary to dwell on the nature of the modifications which the present species exhibits, and which are but the reduplication of the remarkable characters exhibited in the species just named. It may be suggested, however, that sections of this species will vary so much, according to the direction in which they are taken, that no one figure can be depended on as certainly indicative of the species, without very extended and careful comparison. Notwithstanding, however, the complexity of the folding in the present species, the application of the observations already made in respect of *V. decurrens* will make it clear that the free access of sea-water would be perfectly maintained to all parts of the very extended polypiferous surface which is thus gained.

In all these deeply folded species we have seen that the moveable processes are very conspicuous. They are thus conspicuous on that portion of the fold which is most exposed. There would obviously not be room for their operation within the folds, and the traces of them are not found there as they are on the external surface. If their object be that which has been suggested*, their presence and action on this exposed external surface would be amply sufficient for the protection of the polyps in the deeper recesses of the folds, and the presence of the processes there would be useless. The absence of their marked development in those parts is therefore in harmony with that admirable adaptation of means to ends which the results of every part of the present investigation have displayed.

In examining the various and complicated forms which have been thus noticed as included within the genus *Ventriculites*, nothing is more striking than to find that, be the wall of the pouch thick or thin, the thickness of the membrane itself remains always the same. It may be folded up in the most complicated way, but it still retains, in any single piece of it, precisely the same characters as have been described as typical in respect to *V. simplex*. Were other facts wanting, this would alone go far to induce the conclusion which other courses of investigation have already seemed to demonstrate, viz. that we have before us a true Polyzoic *polypidom*; and that polypidom one of the most admirable construction and contrivance. No less interesting illustrations of that conclusion will be found in the widely different forms and modifications of folding which remain to be examined.

* Ante, p. 205, and p. 185 of vol. xx.

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

July 27, 1847.—Wm. Yarrell, Esq., Vice-President, in the Chair.

Descriptions of new or little-known Crustacea in the Collection at the British Museum. By Adam White, F.L.S., Member of the Ent. Soc. of Stettin, and Assistant in the Zool. Dept. Brit. Museum.

Family Maiadæ.

Xenocarcinus, White, Appendix to Jukes's Voyage of H.M.S. Fly.

Carapace long, narrow, knobbed above, with a very long thick beak; beak cylindrical, horizontal, forming an elongated cone, truncated at the end, with two small spines at the very extremity, one on each side. Inner antennæ thickish, inserted in a deep groove, which is triangular in front. Eyes with a short thick pedicel. Outer antennæ springing from the under side of beak just in front of the eyes, eight- or nine-jointed; the first joint elongated, somewhat bent, the second not half its length; both furnished at the end with two or three longish setæ; the other joints forming a bristle. The outer pedipalps together occupying a square space; first joint very narrow at the base, the inner edge finely serrated; second joint very long, sides almost parallel, the end gradually pointed; third joint somewhat pyriform, with a tooth at the tip.

Legs cylindrical, some of the joints slightly curved; claws long, slightly curved, the inner edge with many closely-placed minute teeth.

Tail (of female) trapezoidal, hollowed in the middle; the segments, excepting the terminal, joined in one piece.

A genus closely allied to *Acanthonyx*, Latr.

Xenocarcinus tuberculatus, White.

Carapace with nine tubercles above, placed in three transverse lines, the centre one of the first line double, one placed before the other; the centre one of the third line also double; the two placed transversely; the greater part of the beak covered with minute closely-placed hairs and scales; two short lines of longer hairs on the upper side above and before the eyes; two or three waved longitudinal red lines on the posterior half of carapace, the inner one continued to before the eye.

First pair of legs (in female) short, not reaching to the end of the beak; the claws small, equal, and minutely toothed.

Hab. Long Island, Cumberland Group, Australia. Caught in a seine. Presented to the Museum by J. B. Jukes, Esq., geologist attached to the survey of H.M.S. Fly.

This very interesting form is described in the Appendix to his Narrative of the Voyage. It will be figured in the forthcoming Crustacea of the South Seas, in connexion with Sir J. C. Ross's Voyage.

Chorinus acanthonotus, Adams and White, List of Crust. in Brit. Mus., Appendix, p. 123.

Carapace armed with four long spines, the two front ones rather close together at their bases, and directed a little forwards; the two hinder bifid; the forks of the anterior hinder spine diverging laterally, and those of the posterior divaricating longitudinally; three spines on each branchial region, the *anterior* pointed forward, flattened horizontally; the *middle* slender, curved backwards, upwards and outwards, with two sharp-pointed tubercles at its base directed downwards; the posterior with two divaricating slender spines directed backwards, outwards and upwards. Horns of the rostrum long, flattened, close together at the base, gradually diverging, and curved downwards. Orbital margin armed at its superior part with a long bifid spine; on the *anterior* part having a short bifid spine, and on the *posterior* part bounded by a short spine curved forwards. Inferior margin of the orbit nearly wanting, and its external angle ending in a short sharp tooth-like process. The first pair of legs armed both above and below with a trenchant denticulated crest; the other legs cylindrical, and furnished with two long sharp-pointed spines, situated one on each side of the upper part of the extremity of the *third joints*, and diverging upwards and outwards. Tarsi long, curved, and smooth below. Body covered with long thin hairs.

This species differs from *Chorinus aculeatus* (Edwards, Hist. Nat. des Crust. i. p. 316, and De Haan, Fauna Japonica, pl. 23. fig. 2) in the length and position of the spines, which are not tipped with a knob, but sharp-pointed, and in the thin joints of the posterior pairs of legs being armed with two spines. The peculiarity of the long bifid spine above the orbit must also be regarded as a singular characteristic; the front legs are more slender, the horns of the rostrum are longer and less divaricating than in *C. aculeatus*.

Inhabits Eastern Seas; Borneo (Unsang).

The above description was drawn up by Mr. Arthur Adams, Assistant-Surgeon to H.M.S. Samarang. A figure will be published in the forthcoming illustrated work on the zoological results of that voyage, which in the orders Mollusca and Crustacea are particularly striking.

I may remark that the above species enters into *Chorinus* of Prof. Edwards and Dr. De Haan, but seems to me to be very different from *Chorinus* of Leach, founded on a West Indian and South American type.

Zebrida, White.

Carapace flattened, and about as broad as long. Front horizontal, slightly bent down, and formed of two flattened spines, conical, directed forwards, and slightly diverging at their tips. The orbits circular; the peduncle of the eyes very large and thick, broader from side to side than from above downwards; the cornea of the eyes projecting beyond the outer margin of the front, nearly filling up the orbital cavities, the upper margins of which are salient. The latero-anterior borders of the carapace armed with a single, strong, flattened

process; conical, trenchant, broad at the base, their outer edges slightly elevated, with their points curving forwards. The first joint of the external antennæ is very large, long, cylindrical, and the antennæ are covered by the rostrum. The epistome is very nearly similar to that of *Acanthonyx*. The chelæ, shorter than in that genus, are armed with flattened, conical, slightly obtuse spines. The second joint triangular, with an external and internal conical spine, the external very long and directed upwards and forwards; the *third* joint armed with three spines; one superior posterior, and directed forwards; two anterior lateral, and directed outwards and rounded at their extremities; the fourth joint is crested with a sharp flattened spine. The legs are short, thick, very much compressed; the third joint has two large, flattened, conical spines on the front, directed forwards; the fourth joint has but one flat spinous process on its anterior part, and the fifth joint enlarged and furnished posteriorly with a sharp, flat, curved spine directed backwards.

This beautiful genus is very apathetic when alive; in that respect, according to Mr. Adams's observations, resembling *Lambrus*. In the system it is not far removed from *Acanthonyx* and *Huenia*. *The description is from a female.*

Zebrida Adamsii, White, List of Crust. in Brit. Mus. p. 124.

In colour this species is of a light delicate pink, with dark liver-coloured markings. There is a central line bifurcated anteriorly, where it is lost on the inner bases of the horns of the rostrum, and reaching posteriorly to the last joint of the abdomen, and having external to it a fine, double, somewhat waved line. Extending from the apex of the rostral spines, and meeting at the last abdominal segment, are two broad lines, narrowed in the middle of the carapace; external to this is a fine double line, and on the outside of this is a broad somewhat curved stripe, ending abruptly at the postero-external angle of the carapace; and at the base of the antero-lateral spines is another rather broad linear mark, of the same dark liver-colour.

The third joint of all the legs has two broad, dark, red-brown bands, directed somewhat diagonally across the joint; the fourth and fifth joints have one broad mark of the same colour. The under surface is of a somewhat darker colour. On the outer part of the abdominal segments is a round dark spot. The entire surface of the animal is smooth, hairless, hard, polished and porcellanous. Eyes black.

A very distinct variety, from about twelve fathoms, in the Sooloo Seas, had the carapace of a light green, with deep red-brown stripes, and the legs and chelæ of a pearly semi-opake white, and very distinctly banded with deep red-brown.

The specimen from which the foregoing description is taken was dredged from a sandy bottom at about six fathoms water, near the mouth of the Pantsi River, on the coast of Borneo. The description, it ought to have been remarked, was derived by Mr. Adams

from a living specimen; but even the dried individual in the Museum collection is very distinctly marked.

Family Paguridæ.

Pagurus strigimanus, White.

Red, irregularly spotted with yellow. Eye-peduncles longish, not the length of the anterior margin of the carapace. Carapace with the front part irregularly pitted above, very smooth in the middle, the sides with tufts of long yellow hairs. First pair of legs not much thickened; on the outside covered with thickly-set tubercles, many of which end in a spine; the base of these tubercles in front furnished with a tuft of longish yellow hairs; inside of the hand and of the moveable claw with several slightly raised patches, covered with regular parallel deepish grooves; the claws black, and slightly hollowed at the end; the second and third legs with the two last joints furnished with many small black spines and tufts of long yellowish hairs.

Hab. Van Diemen's Land. From Mr. Gunn's collection.

A species somewhat allied to *Pagurus guttatus*, Oliv.

Pagurus comptus, White.

Whitish, the antennæ ringed with red; the legs with three or four broad red bands. Carapace smooth, with a few punctures on the side, between which and the middle is an impressed somewhat curved line; the front edge with a very wide tooth in the middle.

First pair of legs irregular; the left hand much smaller than the other; the palmar portion of the larger hand somewhat flattened on the outside, and covered with small depressed warts; the claws short and thick, the edges of the claws sharp; the second and third pairs of legs thin, smooth, slightly punctured with a few short bristles; the fourth and fifth legs very smooth.

Hab. Falkland Islands (Antarctic expedition).

Pagurus cavipes, White, List of Specimens of Crustacea in Brit. Mus. p. 60.

Eye-peduncles short and thick; eye very large; scale at the base large and serrated at the end. Carapace with two widish teeth in the front edge, between the outer antennæ and eyes; a transverse groove near the front edge, the anterior angle with a few short spines; anterior legs with the left the larger; the wrist tubercled; the hand behind the moveable claw tubercled; the outer edge of the moveable claw and lower edge of hand serrato-dentate; outside of hand smooth, inside with a few tufts of shortish hairs; the smaller claw with several rows of hairs in tufts. The second and third pairs of legs somewhat serrated on the upper edge; the third leg on the left side with the penultimate joint longitudinally grooved on the outside; the next joint angled and somewhat excavated above, near the upper edge, which is sharpish and somewhat serrated.

Hab. Bramble Key, Australia. Presented by J. B. Jukes, Esq.

Family Thalassinidæ.

Gebia hirtifrons, White.

Beak above depressed, with six or seven longitudinal rows of small tubercles, furnished at the tip with tufts of hairs; stomachal region smooth; false natatory appendage large and ciliated.

Hab. South Seas (Antarctic expedition).

The only specimen which I have seen appears to be very young, as the crust seems hardly formed. It is closely allied to the *Gebia stellata.*

Family Astacidæ.

Astacus Zealandicus, White.

Carapace smoothish; beak as long as the peduncle of the outer antennæ, wide, depressed, with a slight keel near the base; the edges thickened, and with five or six small denticulations. Hands somewhat compressed, the outer and inner edges spined, the spines of the inner edge the longer; the hand with many longitudinal rows of hairs in tufts; wrist with three spines on the inner edge, and a deepish groove above; the caudal plates all of a crustaceous substance; the upper side with many small tufts of depressed hairs.

Hab. New Zealand.

Found by the late Mr. Percy Earl, who collected this and many other objects of natural history now in the British Museum. The *Dendroblax Earlii,* White, a very interesting Lamellicorn Beetle, allied to *Ryssonotus* and *Lamprima,* but with much of the aspect of an *Oryctes,* was named in compliment to him in the "Insect Fauna of New Zealand," published in one of the numbers of the 'Zoology of H.M.SS. Erebus and Terror.' Much was expected from him; but he was drowned in a lamentable shipwreck off the Australian coast.

It is distinct from any species described by Prof. Milne Edwards, Dr. Erichson of Berlin, or Mr. Gray in the 'Appendix to Eyre's Central Australia,' published in 1845.

Family Alpheidæ.

Alope, White.

Carapace very wide, dilated on the sides behind, and sinuated in the middle. Beak short, serrated above, buried in a deep groove, which has a spine on each side in front, almost reaching to the tip of the beak. Eyes with a thick short peduncle, situated in a hollow spine on each side, the outer spine shorter than the inner, which, as has been said, is on the side of the beak.

Inner antennæ thick and elongated; second joint much longer than the third, which is slightly cloven at the end and has two terminal styles, the one very long and cylindrical, the other short and compressed.

Outer antennæ situated outside the inner; the lamellated appendage elongated, longer than the thickened basal joints, the last of which has a tuft of hairs at the end; the terminal fillet very long,

half as long again as the whole body. Outer pedipalps very large, nearly equal in breadth throughout; from the base nearly as long as the body; first joint the longest, nearly reaching to the end of the lamellated appendage of the outer antennæ; third joint more than twice the length of the second, compressed, blunted at the end.

First pair of legs two-clawed, thickish, extending a little beyond the second joint of the outer pedipalps; the second pair of legs filiform didactyle; third, fourth and fifth pairs of legs thicker than the second, monodactyle; claws large, serrated below.

Abdomen largish, middle plate of tail with two pairs of small spines, the first pair beyond the middle.

This genus is allied to *Pontonia*, Latreille, but may be distinguished at once by the foregoing characters.

Alope palpalis, White, List of Crust. in Brit. Mus. p. 75.

The tail has a pinkish hue.

Hab. New Zealand. From the collection of Mr. Earl.

Family Erichthidæ.

Alima aphrodite, White.

Carapace somewhat narrowed in front, deeply sinuated behind; the frontal horn not quite the length of the carapace; the posterior angles of carapace not much extended. Abdomen more than twice the length of the carapace, exclusive of frontal horn; penultimate joint of abdomen with two spines in the middle behind; middle lobe of tail notched in the middle with a gentle sinuation between the notch and the posterior angle, which is very sharp; the posterior edge is furnished with many short regularly placed teeth, giving it a fringed appearance; outer lobes of tail with the middle appendage prolonged into a sharp spine. Anterior pair of legs quite simple.

Hab. South Seas. Antarctic expedition.

Order AMPHIPODA.

Family Gammaridæ.

Ephippiphora.

Head rather large; antennæ distant from each other, the upper pair with the basal joints very thick and corneous, inserted in a deep notch in front of head; two setæ at the end of each, the outer the thicker. Lower pair of antennæ with the basal joint somewhat elongated and furnished with hairs.

Body much compressed, the lateral appendages on the first eight joints very large, and nearly concealing the legs; the appendage of the fourth joint much dilated behind at the end; eighth to eleventh joints slightly keeled on the back; appendages of the three last joints of the abdomen longish, with short spines on the edge behind.

A genus allied to *Orchestia* and *Talitrus*.

Ephippiphora Kroyeri, White, List, p. 130.

The body is very highly polished, the edges of the segments behind somewhat tinged with yellow; the legs and caudal appendages slightly brownish.

Hab. Van Diemen's Land.

Named as a small compliment to the very eminent Danish naturalist, whose researches among the less studied orders of Crustaceæ are so well developed in his published but not easily accessible works. I regret that, excepting a few foliated plates of the large 'Voyage en Islanda,' &c., I had not seen any part of them when I prepared the 'List of Crustacea in the British Museum.'

APTERA?

Family Pycnogonidæ.

Nymphon Johnstonianum, White.

Head with a distinct neck thicker than the articulations between the leg. Eyes two, situated above the insertion of the chelicera, on a rather elevated tubercle, which is pointed at the end. Beak springing from the under side of the head, rounded but not knobbed at the extremity, rather thicker in the middle, with two scales on each side at the base, the extreme apex with a triangular depression.

Chelicera longer than the beak; the two basal joints longer than the third, which is slightly thicker and covered with short hairs; the end with two sharp claws meeting nearly throughout their entire length.

Palpi filiform, 10-jointed; four basal joints small, fifth twice the length of the fourth, and thicker than the sixth, which is equal to it in length; sixth to tenth short, the three last somewhat hairy at the end.

Thorax very narrow, smooth.

Legs eight, slightly hirsute; second and third pairs rather longer than the first; the fourth the shortest; each of the joints with some points at the end.

Tarsi with the first joint very short, the under-side of the second with many spines; claws two, one smaller than the other.

Abdomen somewhat elongate, most slender about the middle, extending to beyond the middle of the second joint of the leg from the base.

In size and general appearance at first sight resembling *Decolopoda australis*, Eights. Boston Journ. Nat. Hist. i. 204. t. 7, but differing from it in the number of the legs, structure of the head and claws, &c.

Hab. South Seas. Capt. Sir E. Belcher, R.N.

This herculean species is named after Dr. George Johnston, of Berwick-upon-Tweed, who among his many valuable works has monographed the British *Pycnogonidæ*. I am aware that Mr. Goodsir has named a *Nymphon Johnstonii* after him, but most probably the present species will be found to form the type of a new genus.

Nymphon Phasma, White.

Head with a longish neck, the greater part of which is as thin as or thinner than the articulations between the legs, thickened in front.

Beak thick, blunt, and somewhat knobbed at the end.

Eyes two, situated on a sharp-pointed tubercle, placed between the first pair of legs, somewhat in front of insertion.

Chelicera somewhat longer than the beak, thick, two-jointed; second joint rounded, furnished with two claws which meet throughout.

Palpi elongated, filiform, 10-jointed; three basal joints small; fourth joint very long; fifth joint shorter than the fourth, with a slight hook at the end; sixth joint about the same length as the fifth, but without hook at the end; four last joints short, somewhat curved.

Legs eight, somewhat hirsute, the third leg perhaps shorter than the others.

Tarsi with one claw, the under-side furnished with many small spines.

Hab. South Seas. Capt. Sir Edw. Belcher, R.N.

This may possibly be the other sex of the preceding. Neither of them have any trace of oviferous legs.

Additional Observations on Chitones. By J. E. Gray, Esq., F.R.S. etc.

Since the publication of my former paper I have continued my researches on these animals, and now propose to add four groups to those which I then described: three of these genera were proposed as sections of the genus *Chiton* in my former paper, but I have since found that they each present peculiar modifications in the structure of the plate of insertion of the valves; and the other is a genus which I had overlooked, though founded on two of the English species of the family. On re-examination I think that the genus *Chiton* should be confined to the species which have a single notch on the plate of insertion of the central valves, and the edge of the plate of insertion pectinately lobed, which is the case with the species marked as belonging to the section * and ** (Annals, vol. xx. p. 131.), except *Chiton Barnesii* and *Ch. evanidus.*

1. Radsia.

Posterior valve entire; margin covered with regularly-disposed imbricated smooth scales; margin of insertion of the central valves pectinately divided, and each furnished with two notches.

Radsia Barnesii. Chiton Barnesii, *Gray.*

2. Callochiton.

The valves keeled, the hinder valve entire; the plates of insertion rather short, thick, of the terminal valves divided into many, and of the central valves into four bifid lobes. Margin with imbricate scales.

* *Margin with lanceolate, elongate, erect, closely-pressed scales.*

Callochiton lævis. Chiton lævis, *Mont., Lowe, Z. Jour.* v. t. 5, f. 1.

Ch. discors, *Maton & Racket.* Ch. punctulatus, *Maton.* Ch. septemvalvis, *Mont.* Ch. corallinus, *Risso.*

** *Margin with ovate imbricate scales.*

Callochiton evanidus. Chiton evanidus, *Sow. Ill.* f. 139.

3. Ischnochiton.

Valves thin; posterior valve entire; the plates of insertion very thin, smooth-edged, of the central valves each with a single notch; margin covered with very small imbricate scales.

* *Scales of mantle transversely grooved.*

Ischnochiton textilis. Chiton textilis, *Gray* = Ch. longicymba, *Blainv.*

Ischnochiton limaciformis. Chiton limaciformis. West Indies.

Ischnochiton Magdaliensis. Chiton Magdaliensis, *Hinds.*

Ischnochiton alatus. Chiton alatus, *Sow.* Philippines.

** *Scales of mantle minute, granule-like.*

Ischnochiton marginatus. Chiton marginatus, *Mont.* Ch. cinereus, *Lowe, Z. J.*

4. Leptochiton.

The valves rounded, thin; posterior valve entire; the plates of insertion rudimentary, without any notches on either the terminal or central valves. Mantle covered with granular scales.

Leptochiton cinereus. Chiton cinereus, *Montague* = Ch. asellus, *Lowe, Zool. Jour.* var. white, Chiton albus.

Leptochiton Hanleyi. Chiton Hanleyi, *Bean.*

Leptochiton cajetanus. Chiton cajetanus, *Poli.* Lepidopleurus cajetanus, *Risso.*

Should the form of the plates of insertion of any specimen not be sufficiently seen, they may be easily made visible through the inner side of the mantle by their being soaked a few hours in a weak solution of caustic potash, but care should be taken that they are not left too long in soak, nor the solution be too strong, otherwise the margin will be dissolved. But should the valves be wished to be kept separate, this is the best way of separating them, as the plates of insertion are cleaned, and not broken, as they are likely to be if taken from the mantle. I may remark that the number of notches in the plates of insertion is sometimes, but as far as I have observed, very rarely, liable to variation; in one specimen of *Chiton Bowenii* I have observed that the plate of insertion of the last valve but one has two notches on one side, but the normal single one of the genus on the other.

ENTOMOLOGICAL SOCIETY.

August 3rd, 1846.—Thomas Marshall, Esq., Vice-President, in the Chair.

Among the donations were a number of *Arpedium subpubescens*, a rare species of *Staphylinidæ*, sent by A. H. Haliday, Esq., for distribution among the members.

Mr. Gutch exhibited several boxes of *Coleoptera* from Central Europe, and a new species of Fritillary butterfly from Servia. He also presented to the Society a quantity of specimens of *Simulium Columbatchense,* a small dipterous insect which attacks the cattle in the Bannat, frequenting all the moist parts of the body, as the nostrils, anus, &c., and causing the death of great numbers of these animals. They occur on both banks of the Danube, appearing in clouds, and are supposed by the common people to be bred in a hole in a mountain where the body of the dragon slain by St. George was deposited.

Mr. Westwood exhibited a small box of *Coleoptera* from Western Tropical Africa, including numerous rare *Tenebrionidæ.*

Mr. W. W. Saunders exhibited a small box covered with the cases formed by the larvæ of an Australian species of *Oiketicus,* and including a number of specimens illustrating the natural history of six species of that genus, sent from the interior of New South Wales by Mr. Stevenson.

The following memoirs were read :—

"Descriptions of some new species of *Helæus.*" By the Rev. F. W. Hope, F.R.S. &c.

"Description of a new species of *Paussidæ* from India." By J. O. Westwood.

"Note relative to the Larva of a species of Dipterous insect (evidently *Anthomyia canicularia*) infesting the human body." By Mr. George Downs, F.R.C.S.E.

"Description of a new genus of Lamellicorn Beetles from India." By J. O. Westwood.

"Note on a remarkable migration of swarms of common White Butterflies across the Straits of Dover on the 5th of July, flying from the south or south-west, and which were also observed at Folkstone, and on the passage to Ostend, the wind blowing at the time lightly from the eastward ; and on the Black Dolphin of the hop-plantations, regarded as the larva of the *Coccinella.*" By H. L. Long, Esq.

Note from Mr. Louis Frazer, Corresp. M.E.S., giving an account of his entomological pursuits in Northern Africa.

"Notes on the Entomology of Australia, as observed during an expedition from Fort Burke to Port Essington." By Mr. Stevenson, Corr. M.E.S. Communicated by W. W. Saunders, Esq.

September 7th.—A. Ingpen, Esq., Vice-President, in the Chair.

The following memoirs were read :—

A note from Mr. Long of Dover, on an attempt to naturalise *Palingenia Virgo* (a continental species of *Ephemeridæ* remarkable for its snow-white wings) by bringing over the ova in a bottle filled with the water of the Rhine where they occur, and by placing them in the rivers in England. It did not appear that the experiment had been successful. Also further notes on swarms of white butterflies observed between Boulogne and Calais a few days after the 5th of July.

Note from the Rev. F. W. Hope on swarms of white butterflies,

P. Napæ and *Rapæ*, observed at Southend, Essex, on the 2nd of September, which disappeared the following day after depositing vast numbers of eggs; and on the occurrence of numerous specimens of *Sphinx Convolvuli* and *Atropos*.

"A memoir on the œconomy of the Driver Ants of Tropical Africa." By the Rev. T. Savage.

Mr. Evans exhibited various larvæ from New Holland.

Mr. W. W. Saunders exhibited a box of insects from Adelaide in Australia, containing illustrations of the natural history of various interesting species of *Lepidoptera*, with their parasites. Also the sexes of several new species of *Thynnidæ*, &c.

Mr. F. Bond exhibited a living specimen of *Locusta Christii* in full vigour, taken near Kingsbury, Middlesex. Also a remarkable variety of *Hipparchia Janira*, of which the ground-colour of the wings was nearly white.

Messrs. Stevens and Weir exhibited specimens of *Sphinx Atropos* reared from the potato, remarkable for having been produced much earlier in the year than usual. Mr. Weir also exhibited two specimens of *Deilephila Livornica*, taken in the spring at Lewes, Sussex.

Mr. J. F. Stephens stated, in allusion to the unusual heat of the present season, that he had observed at least three broods of *Pontiæ* and two of *Bombyx lubricipeda* during the summer.

October 5th.—The Rev. F. W. Hope, F.R.S., President, in the Chair.

Mr. Weir exhibited specimens of *Deilephila Celerio* and *Cynæda dentalis* from Lewes; also of *Locusta Christii* from Camberwell.

Mr. Evans also exhibited the same species of locust taken at the Nash Lighthouse near Cowbridge, Glamorganshire, in September, and stated that another specimen had been taken in the garden of the gate-house at Hyde Park Corner. Another taken at Littlehampton was exhibited by Mrs. Attegus, and Mr. Hope mentioned its occurrence at Southend. The following additional localities were also communicated by other members present: St. James's Park, Kennington, Margate, Epping, Durham, Glasgow, Cromer and the adjacent district (where it was numerous), and Newcastle.

Mr. Marshall stated that *Deilephila Celerio* had been taken at Hackney; and Mr. Moore, jun., exhibited a larva of *D. Galii* having a red head and anal horn, found upon the mullein near Southend. Also a Geometrideous larva found on the coast at the same place, to the body of which several long slender fungi were attached.

Mr. Hope exhibited specimens of *Sphinx Atropos*, and stated that he had observed that the white-coloured varieties of the larvæ feed on the ash, whilst amber-coloured specimens feed on the potato.

Mr. E. Doubleday stated that the larvæ had been found at Cockermouth on *Euonymus europæus*; and Mr. S. Stevens mentioned that they had been so abundant at Margate that they had been collected as food for chickens. Mr. Doubleday also noticed, that on dissecting some of the specimens, both of *Sphinx Atropos* and *Convolvuli* recently disclosed, not one of the females was found to have

the eggs developed in the ovaries. He also mentioned that *Graphiphora subrosea* had been recently captured at Whittlesea Mere, thus proving it to be indigenous; which was the more interesting, as it agrees in the structure of the antennæ with a North American group of which there is no other European representative. *Deiopeia pulchella* had also been captured at Epping at the end of September. He also stated that the larva of *Polia occulta* feeds upon species of *Polygonum*, and not on the dandelion as represented by some authors.

Mr. Hope stated that two specimens of *Catocala Fraxini* had been taken at Southend.

The following papers were read:—

Extracts from a letter addressed to Mr. Westwood by Captain Hutton, containing a series of observations on the Indian species of *Papilio*.

Extracts from a letter addressed to Mr. Westwood by R. Templeton, Esq., containing notices of some of the *Lepidoptera* of Ceylon.

The completion of Mr. Savage's memoir on the driver ants was also read.

Mr. E. Doubleday, in allusion to the two former communications, stated his belief that *Papilio Panope* and *similis* are the sexes of one species; also that *P. Pammon* and *Polytes* are varieties of one species, as affirmed by Boisduval; and that the insects regarded as the two species, *P. Epius* and *Demoleus*, by Captain Hutton, were the sexes of one species (as indeed Mr. Templeton had stated in his letter).

November 2nd.—The Rev. F. W. Hope, F.R.S., President, in the Chair.

Mr. Newport exhibited a box of *Coleoptera*, &c. from Melbourne, South Australia, including a large new species of *Eucranium*?, *Cerapterus Hopii*, &c.; and also a species of *Blatta* of which the left hind leg had evidently been reproduced, being smaller than the other. Instances of the reproduction of the antennæ, but not of the feet, had hitherto been noticed in this group.

Mr. Griffith stated that he had observed during the preceding autumn, on one small spot of woody ground at Addington Hill near Croydon, a very great number of specimens of *Cynthia Cardia*.

Captain Frend stated that he had found *Vanessa Urticæ* alone in some quantity on the summit of the Sierra Novada in Spain, 16,000 feet above the level of the sea.

Mr. Weaver exhibited a new British *Noctua* allied to *Hadena adusta*, and other rare *Lepidoptera* from Perthshire.

Mr. F. Bond exhibited a living specimen of *Sphinx Atropos*, and stated that he was convinced that the cry emitted by this insect was not produced by the moveable appendages at the sides of the thorax, as he had found that the noise was equally strong when the sides of the thorax were violently compressed and held tight. Mr. Newport, who had also examined the insect whilst alive, stated that in his opinion the noise was either produced by the lateral friction of the parts of the spiral tongue (maxillæ) against each other, or by their

combined friction against the front of the prothorax, but added that this view required further observation.

Mr. F. Bond exhibited a very small papyriceous nest of a wasp, which had been suspended to a twig by a piece of horse-hair.

Mr. Moore, jun., exhibited several chrysalids of moths, the interior of which was filled apparently with minute parasitic *Acari*.

Mr. Westwood exhibited an extensive series of *Cremastocheilidæ*, from the collections of the Royal Museum of Stockholm, Messrs. Hope, Schaum (including the types of the species described by M. Gory), Turner, &c. He also stated that *Entomobia Apum*, described by Signor Costa (in a work presented the same evening), was the *Braula cæca* of Nitzsch; and that M. Blanchard had recently published a memoir on the impregnated state of the *Hippoboscæ*, in the bodies of which he had detected larvæ, contrary to the observation of M. Léon Dufour.

Mr. Newport, in reference to the statement made at the last meeting, of the immature state of the ova in some specimens of *Sphinx Atropos* and *Convolvuli*, observed that he had recently dissected a female of the latter species which had remained in the chrysalis state nearly its full period, and that he had detected the ovaries, but in a very slightly developed state, and which, he did not consider, would have ever arrived at their full state of development. A considerable discussion as to the cause of this non-development of the ova took place, in which Messrs. Marshall and Westwood having suggested that it was owing to the great heat, Mr. Newport stated that he had found the ova as fully developed in specimens of *Vanessa Urticæ* which had been produced from the chrysalis in from $8\frac{1}{2}$ to $9\frac{1}{2}$ days, in a mean highest temperature of 70° to 75°, as in others which had remained in chrysalis thirteen or fourteen days with a mean highest range of temperature of from 55° to 60°. *V. Io* was developed in a few hours over ten days, when the mean lowest temperature during that period was 71°·06, and the mean highest 75°·55. This may afford some explanation of the fact, that the two broods of *V. Io* usually appear in this country only in the hottest parts of summer, July and August, when, in its natural haunts, it is usually about fourteen days in the pupa state.

Mr. E. Doubleday exhibited drawings of the ungues of the two species of *Leptocircus*, which he had found to be simple in the one and deeply bifid in the other. He also stated that Mr. Wing had obtained a larva of *Sphinx Celerio* found on a vine-tree at Paddington.

The abundant occurrence of *Vanessa Antiopa* in different places during the past autumn was also noticed, especially at Tunbridge Wells by Mr. Stephens, at Yarmouth by Mr. Ingpen, and at Yaxley by Mr. F. Bond.

December 7th.—W. Spence, Esq., F.R.S., Vice-President, in the Chair.

Mr. Moore, jun., exhibited a quantity of flour infested with mites; also the eggs of some species of *Acarus*? arranged in rows on the

under side of several feathers of birds; likewise a very minute paper nest of *Vespa Britannica*.

Mr. Westwood exhibited drawings and specimens illustrating the transformations of the common flea.

Mr. E. Doubleday read extracts from a letter addressed to him by M. Guénée, stating that he had become associated with M. Boisduval in the 'Histoire naturelle des Insectes Lépidoptères,' and that the nocturnal *Lepidoptera* would be described by him.

Descriptions of two new species of *Papilio* were read by J. O. Westwood.

Mr. Thwaites gave an account of the observations which he had recently made on the habits of *Tinea granella*, in granaries at Bristol. The moth appears in August, at which time it is advisable to attempt its destruction by fumes of sulphur. The insects remain in the larva state through the winter, being full-fed in October, when they seek out winter-quarters in the woodwork of the granaries, such as the beams, floors and supports, committing much damage by boring into them to the depth of half an inch, or sometimes an inch. If the wood be hard they do not excavate so deeply, but cover the surface with a thick layer of excrement; and it had been observed that they do not fear attacking kyanized wood; it was consequently suggested that it would be serviceable to coat the wood with plates of lead or other metal. Mr. Spence noticed how singularly this insect seemed to set at nought the supposed objections to insect life, attacking the knots of the wood, which were of course most strongly saturated with turpentine. On examining the debris left by these insects with a microscope, it was found to consist only of minute particles of gnawed wood, which did not appear to have undergone the action of the stomach; and it had been observed, that when there was a sufficient mass of debris for their defence they do not bore into the wood. Mr. Spence also alluded to the change of instinct which these circumstances evidently proved the insects to have undergone from their natural state.

LINNÆAN SOCIETY.

April 20, 1847.—E. Forster, Esq., V.P., in the Chair.

Read a paper "On a new genus of Plants of the family *Burmanniaceæ*." By John Miers, Esq., F.R.S., F.L.S. &c. &c.

Ophiomeris.

Perianthium superum, tubulosum, gibbosum, caducum; fauce laterali annulo semiclausâ; limbo 6-partito, laciniis 3 exterioribus brevibus ovatis, 3 interioribus longissimis subulatis. *Stamina* 6, libera, infra perianthii faucem inserta et ejus laciniis opposita, inclusa, versus tubum retroflexa; filamentis petaloideis, margine appendiculatis; antheris adnatis in sinu filamentorum terminalibus, 2-locularibus, loculis longitudinaliter dehiscentibus. *Ovarium* inferum, 1-loculare; placentis 3 parietalibus, medio ovuligeris; ovulis indefinitis, anatropis. *Stylus* brevis. *Stigmata* 3. *Fructus* turbinatus, truncatus, apice operculatim dehiscens, 1-locularis. *Semina* plurima, scobiformia. *Embryo* ignotus.—Plantæ Brasilienses, *hyalinæ, super lignum cariosum parasiticæ;* rhizomate

tuberoso, fibrillis numerosis; caule *simplici, erecto, subflexuoso, angulato, ferè aphyllo;* flore *solitario, terminali,* 2—4-*bracteato;* bracteolis *brevibus vel sub flore vel in caule medio, erectis;* perianthii *tubo subhyalino, laciniis interioribus roseis, exterioribus flavis, coronâ luteâ margine aurantiacâ;* fructu *hyalino.*

1. O. Macahensis, caule nudo, bracteolis 2 v. 3 florem solitarium terminalem suffulcientibus.
Hab. ad Macahè, in Prov. Rio de Janeiro.
Planta 2—3-pollicaris.

2. O. Iguassuensis, caule subnudo medio bracteolis 3 v. 4 in verticillum dispositis instructo.
Hab. ad Iguassù, in Prov. Rio de Janeiro.
Planta vix pollicaris.

Mr. Miers compares this Brazilian genus with *Thismia*, Griff. (characterized at p. 195, vol. xv. of Annals), of which he has seen specimens in the herbarium of Sir William Hooker, as well as a specimen probably of the same species collected by Capt. Champion in the island of Ceylon. He regards *Thismia* and *Ophiomeris* as constituting a distinct section of the family *Burmanniaceæ*, which he proposes to subdivide as follows:—

Burmanniaceæ.

I. Burmannieæ. *Perianthium* tripterum. *Stamina* 3. *Ovarium* 3-loculare. *Placenta* centralis.

Capsula longitudinaliter dehiscens	1. *Burmannia*, L.
——— transversè fenestrata	2. *Gonyanthes*, Blum.

II. Apterieæ. *Perianthium* simplex. *Stamina* 3. *Ovarium* 1-loculare. *Placentæ* 3, parietales.

Capsula irregulariter 3-valvis	3. *Dictyostega*, Miers.
——— lateraliter hians	4. *Cymbocarpa*, Miers.
——— apice 3-valvis. *Stamina* appendiculata	5. *Apteria*, Nutt.
——— irregulariter dehiscens. *Petala* nulla	6. *Gymnosiphon*, Blum.

III. Thismieæ. *Perianthium* simplex. *Stamina* 6. *Ovarium* 1-loculare. *Placentæ* 3, parietales. *Pericarpium* circumscissum.

Corollæ tubus æqualis. *Stamina* monadelpha	7. *Thismia*, Griff.
———— gibbus. *Stamina* libera ...	8. *Ophiomeris*, Miers.

The paper concludes with some observations on the affinities of these plants, and of *Triuris*, Miers, and *Peltophyllum*, Gardn.; and was illustrated with detailed drawings of *Ophiomeris Macahensis*, and of the flower of *Thismia Brunonis*, Griff., for comparison.

May 4.—E. Forster, Esq., V.P., in the Chair.

Read a paper "On *Jansonia*, a new genus of *Leguminosæ*, from Western Australia." By Richard Kippist, Libr. L.S.

Jansonia.

Char. Gen. *Calyx* ebracteatus, bilabiatus; labio superiore ferè ad basin bifido; inferiore 4-plò longiore, 3-partito; segmentis omnibus acutis. *Corollæ papilionaceæ petala* longè stipitata; *vexillum* ovato-lanceolatum, reflexum, *alis* oblongo-ellipticis multò brevius; *carinæ* com-

pressæ (alis tertiâ parte longioris) petala oblonga, basi auriculata, dorso connata. *Stamina* 10, libera, vel imâ basi cohærentia, inæquilonga, persistentia. *Ovarium* villosissimum, substipitatum, stipitulo basi vaginulâ cincto, pauci- (4—6) ovulatum, suturis non inflexis. *Stylus* filiformis, elongatus, apice incurvus, glaber. *Stigma* parvum. *Legumen* . . . . . .—Suffrutex Novæ Hollandiæ Austro-Occidentalis, Brachysemati, R. Br. *proximus*; ramis *erectis vel adscendentibus*; foliis *oppositis, oblongo-ovatis, emarginatis, mucronatis, utrinque reticulatis, margine revolutis, subundulatis, minutè denticulatis*; stipulis *lanceolato-subulatis, demùm deciduis*; floribus *sessilibus, congestis in* capitula *cernua*, 4-*flora, bracteis* 4 *ovatis decussatis, coriaceis, fuscis, extùs sericeis suffulta, ramulos breves axillares terminantia.*

Jansonia formosa.

Hab. in Novæ Hollandiæ Orâ Austro-Occidentali, ad "Scott's River" (1842), *Gilbert* (*v. s.*).

Obs. Specimen habitu debiliore, et foliis ramulisque pubescentibus paulò diversum a *D. Jac. Drummond* ad "Swan River" lectum (*v. s. in Herb. D. Lemann*).

The nearest affinity of *Jansonia* is with *Brachysema*, R. Br., with which genus Mr. Kippist states that it agrees in its unguiculate petals, in the form and unusual length of the keel, in the extreme shortness of the standard, in its elongated filiform style, and in its shortly stalked villous germen, surrounded at the base by a minute fleshy ring; but it is abundantly distinguished by its capitate inflorescence, by the remarkable inequality of its calycine segments, by the much greater length of the claws of its petals, and by the paucity of its ovules, which do not appear to exceed six in number. Mr. Kippist also compares it with *Leptosema*, Benth., which is clearly distinguished by its bibracteolate calyx, composed of two nearly equal lips, the uppermost of which is very slightly bifid; its scarcely unguiculate vexillum; its wings about equal in length to the keel; the distinct inflexion of its *carinal* suture; as well as by its inflorescence, that of *Leptosema* being a densely crowded raceme, while in *Jansonia* the flowers are perfectly sessile and arranged in a verticillate manner round a common axis, which is slightly prolonged beyond the point from whence the flowers spring in the form of a short mucro.

The genus is dedicated to the memory of the late Joseph Janson, Esq., F.L.S.; and the paper was accompanied with a drawing of the plant, comprising details of its parts of fructification.

BOTANICAL SOCIETY OF EDINBURGH.

Dec. 9, 1847.—The Rev. Dr. Fleming, President, in the Chair.

The following communications were read:—

1. "On *Anacharis Alsinastrum*, a new British plant," by Chas. C. Babington, Esq., with a synopsis of the other species of the genus, by Dr. J. E. Planchon. See Annals, present volume, p. 81.

2. "On the Reproduction of Cryptogamic Plants," by the late William Stark Dougall, Esq., communicated by Dr. Balfour.

The first part of this paper was read—viz. On the mode of formation of spores in *Algæ* and *Characeæ*.

In the introductory remarks, the author examines the opinions entertained by botanists as to the existence, in these plants, of bodies equivalent to the stamens and pistils of the higher orders of vegetables. The arguments in favour of their existence are, the presence in the same or different individuals of two kinds of cells, the union of which in some way appears to be necessary for the production of germinating spores. These cells sometimes exist in the same cavity, so that the functions cannot be always easily detected; at other times they are separate. In the latter case, the spores are occasionally produced by the actual conjugation of two individuals of the same species. The spores, when first discharged, frequently exhibit ciliary movements, like those seen in the ova of animals. And lastly, the cells representing anthers often contain phytozoa, or moving bodies similar to the spermatozoa of animals.

The reproduction of *Algæ* is then brought under consideration as observed in *Diatomaceæ* and *Confervaceæ*, with their cell-division, conjugation, and development of endochrome; in the *Fucaceæ* and *Ceramiaceæ*, with their *antheridia spores* and *tetraspores*; and in *Characeæ*, with their *globule* and *nucule*.

In regard to the latter tribe, the following points are noticed as favouring the opinion that the globule may be compared to an anther and the nucule to the pistil:—their co-existence and close proximity —the opening of the valves of the globule to allow the escape of filaments and phytozoa (similar to those of Fuci, which Thuret and Decaisne have shown to be connected with staminal functions)—the existence of an opening at the apex of the nucule allowing communication with the interior—the capability of germination in the contents of the nucule when mature—and the decadence of the globule prior to the ripening of the nucule.

3. Dr. Balfour read a communication from Mr. Charles Lawson, jun., relative to the cultivation of potatoes by cuttings of the stems. Six cuttings were planted on the 16th of June, 1847, kept in a warm frame for six weeks and then planted out; they produced twenty tubers of very considerable size.

4. Mr. Brand read an extract from a letter from W. A. Stables, Esq., relative to the plantations recently made on Lord Cawdor's estate in Nairnshire:—"The forester planted 230 imperial acres in nine days—57 women and boys being employed each day, and the average number of trees planted by each was 1566 a day. Two-thirds of the plants were larch, and the remainder Scotch fir—in all, 3465 plants per acre. The plants were two-years-old seedlings. The cost of inclosing was 75*l.* 6*s.* 10*d.*, and of planting 16*l.* 8*s.* 8*d.*—together, 92*l.* 5*s.* 6*d.*, or about 7*s.* 7*d.* per acre of outlay."

At this meeting the following gentlemen were elected office-bearers for the ensuing year:—Rev. Dr. Fleming, President; Drs. Greville, Balfour, Christison, Neill, Vice-Presidents; Sir W. Jardine, Bart., Dr. Seller, Dr. Lowe, Mr. W. M'Nab, Mr. C. Lawson, jun., Prof. Allen Thomson, Mr. J. Marshall, jun., Mr. R. Holden, Mr. Wm. Ivory, Mr. W. Wright, Councillors; Mr. Brand, Treasurer; Professor Goodsir, Secretary; Dr. Douglas Maclagan, Foreign Secretary;

Dr. Parnell, Curator of the Museum; Mr. J. M'Nab, Artist; Mr. Evans, Assistant Secretary and Curator.

Jan. 13, 1848.—The Rev. Dr. Fleming, President, in the Chair.

Among specimens of Portuguese plants presented to the Society by Sir Walter C. Trevelyan, were some marked as having been collected in the streets of Cadiz and Lisbon, viz. *Frankenia pulverulenta*, *Illecebrum echinatum*, and *Hippia stolonifera*; these plants are remarkable for their habit of flourishing in the interstices of the paving stones of much-frequented thoroughfares, but growing so close to the ground that they are but little injured by the feet of passengers. The collection also contained specimens of *Statice lusitanica* from Persoon's locality.

The following communications were read:—

1. "On the Reproduction of Cryptogamic Plants," by the late William Stark Dougall, Esq., continued. Part second: Mode of formation of spores in Fungi, Lichens, Musci, and Hepaticæ. In this part of the paper the author first considered the reproductive organs in the various divisions of the natural order *Fungi*, and pointed out the analogy which they bear to *Algæ* in many respects. Thus in the lower members of the order the mode of reproduction may be compared to that observed in *Confervaceæ*, both as regards the development of spores and their movement. In other cases the formation of spores at the dilated ends of filaments or sterigmata resembles in some degree what takes place in *Vaucheria*. He regarded the filamentous paraphyses as being concerned in the fertilization of the contents of the *asci* and *basidia*.

He next noticed the natural order *Lichenes*, and considered the production of spores, whether naked or in *asci*, which are united in the form of *apothecia*; and of the round green bodies called *gonidia* or *gongyli*, which are either single or in groups. He stated that little was known in regard to the formation of the latter bodies, and that the subject of reproduction in Lichens was still very obscure; although it might be said to resemble that of some Ascomycetous Fungi.

The *Ricciaceæ*, *Marchantiaceæ*, and *Jungermanniaceæ* were next brought under notice. In these orders, organs which appear to be equivalent to stamens and pistils were pointed out, as well as certain bodies which might be reckoned as buds or gemmæ. The presence of phytozoa with cilia and of spiral fibres or elaters was also remarked.

The *Equisetaceæ* were looked upon as in many respects allied to the last-mentioned orders, especially in developing spores with spiral filaments.

The true *Mosses* were then alluded to, and in them the author believed that reproductive organs have been demonstrated in the *antheridia* with their granular contents and phytozoa, and the *thecæ* or *sporangia* with their spores. He detailed the various species in which phytozoa had been detected by Thuret, Brongniart, Meyen, and Unger, pointed out the monœcious, diœcious, polygamous, and

hermaphrodite arrangement of the organs, noticed the difference between spores and gemmæ, and concluded by stating the following arguments in favour of the sexual nature of the spore-formation in the whole muscal alliance:—1. The existence of antheridia and pistillidia, and the production of true spores by the latter. 2. The existence of phytozoa in the antheridia. 3. The relation of antheridia and pistillidia to one another in point of periodicity, both as regards development and function. 4. Their relative arrangement, either together or separate, on the same or on different individuals. 5. The provisions by which the coming in contact of the contents of the antheridia with those of the pistillidia may be effected.

2. "On the Ovule of *Euphrasia officinalis*," by George Dickie, M.D., Lecturer on Botany, King's College, Aberdeen.

The paper was illustrated by drawings, and will appear in the 'Annals of Natural History' and in the Society's 'Transactions.'

3. Dr. Fleming exhibited a specimen of the stem of *D'Urvillea utilis* (Bory) from Acapulco, and made some remarks on the peculiarity of its structure, more particularly as regards its transverse partitions and large air-cells.

4. Dr. Dickie communicated the discovery of a new Diatomaceous plant, allied to *Meloseira*, in the neighbourhood of Aberdeen. It is the *Orthoseira* of Thwaites, and will be published under the name of *O. Dickiei* (see p. 168 of the present number). Dr. Dickie also announced from Mr. Thwaites the discovery of a new species of *Dickieia*, consisting of binate frustules at the end of mucous appendages, like the *Omacoccus* of Hassall.

Dr. Bell Salter communicated the discovery of *Zostera nana*, in large quantities, on the shores of the Isle of Wight near Ryde.

Mr. Babington sent notices of the following plants having been added to the British Flora since the publication of the second edition of his 'Manual,' specimens of all of which are in his possession, viz.:—*Thalictrum minus* β. *glandulosum*, Koch; *Ranunculus Petiveri* α. *Mairii*, Godr., β. *Candollii*, Godr.; *Sagina ciliata*, Fries; *Campanula rotundifolia* β. *lancifolia*, Koch; *Simethis bicolor*, Kunth; and *Carex brizoides*, Linn.

Dr. Balfour exhibited specimens of *Ceramium acanthonotum*, from the shores of the Frith of Forth.

MISCELLANEOUS.

BRITISH MOLLUSCA.

The *Truncatella atomus* of Philippi (Moll. Sic. ii. p. 134. t. 24. f. 5) is found in the following localities mixed with the *Helix nitidissima* of Adams (Linn. Trans. v. p. 4. t. 1. f. 22, 23, 24): Swansea and adjacent bays; Tenby (the locality given by Adams); Weymouth; Scarborough; Falmouth; Cork Harbour; Bantry Bay; Belfast (William Thompson, Esq.), and Skye (George Barlee, Esq.). It appears to be the *Helix bicolor* of Adams (L. T. v. p. 4. t. 1. f. 25, 26, 27), and referable to the genus *Skenea* of Fleming. Philippi has omitted in his figures of the shell to indicate its size, which may have misled

inquirers for it. The animal and shell are closely allied to the *Dentalium Trachea* (or *imperforatum*) of Montagu (*cæcum* of Fleming), for which that accurate observer of British Mollusca, Mr. Clark, proposed the significant name of *Dentaliopsis*. It may have been confounded by British conchologists with the young of *Skenea depressa*, but is a very distinct species. The *Helix nitidissima* of Adams was evidently known to Montagu, as in one of his letters to Mr. Dillwyn he mentions having found "a recent (minute) British Ammonite," which this beautiful species resembles in form and markings.—J. Gwyn Jeffreys.

Have Ants, when deprived of their Queen, the power of selecting one of their number and converting her into a fertile female?

Phil. Hall, Leeds, January 10, 1818.

Dear Sir,—I shall feel obliged if any of your entomological readers can inform me whether they know a species of Black Ant, inhabiting this country, whose *queen* is *not* distinguished from the workers by her *larger size*. My reason for wishing for this information arises from the following circumstance:—In August 1846 I procured a colony of black ants, which I supposed were the *Formica fusca*, from the woods near Kirkstall Abbey. I found them beneath a patch of moss and stones, and consisting of about sixty individuals. I suspected at the time that the queen escaped me, as no one specimen appeared distinguished from the remainder by *regal* characters, which I frequently regretted. On the 29th of March 1847, however, when looking at my formicary, I observed one ant carrying a small white mass in its mandibles, which upon closer examination I found to my great astonishment was an egg; on the following day there were probably twenty eggs, and the number continued to increase until June, when there would be at least sixty, of different sizes, and some had become larvæ. Two of these increased in size so much as to lead me to suspect they would prove the larvæ of queens, being considerably larger than the ants themselves. By the end of July they had become pupæ, and were inclosed in cocoons as large as a grain of wheat; these now appeared to absorb all the attention of the workers, and the remainder of the eggs and larvæ decreased, for want, as I presume, of sufficient attendance. During the month of August I found one day all dead or dying with the exception of three or four specimens, which I could not account for unless it arose from the formicary having been exposed to a great heat from the sun in my window during the day, from which they could not escape, having forgotten to put up the shutters, which are for the prevention of light and too great a degree of heat.

The point however upon which I want information as connected with the above colony is this:—From whence did the eggs proceed? As I have before stated, there was not *one* I could suspect more than another of being the royal mother from external characters, while in seven other colonies of different species I then possessed, the identification was very easy and self-evident. Now as we know bees when deprived of their queen have the power of selecting one or more

larvæ of workers (which are barren females) and converting them into queens by feeding them with peculiar food, used only for such as are destined for sovereignty, and as the working ants are also *barren* females,—is it probable that the ants have the power by selecting one of their number to convert her into a *fertile* female by the means of some peculiar treatment which may cause the more full development of those organs essential for impregnation? I am aware in the case of the bees this is accomplished in infancy; still, as the *matured* workers have the *female* organs *perfect*, though in a comparatively *low* state of development, is it irrational to suppose, that when circumstances make it necessary, even at a *later* period of life, these same all-important parts may be stimulated and rendered fit for the accomplishment of so desirable an object as reproduction? I am also aware that working ants, like working bees and wasps, do occasionally lay eggs; but when this does take place, they invariably produce males, which I suspected could not be the case with those alluded to, from the great disparity of size observable in the larvæ and cocoons, and which I should have been able to ascertain with certainty had not the before-mentioned accident befallen them.

I remain, dear Sir, yours respectfully,

To Richard Taylor, Esq. HENRY DENNY, A.L.S.

On the Digestive Apparatus of the Gnat, Culex pipiens, *Linn.* By F. POUCHET.

The digestive apparatus of the Gnat is highly complicated: the mouth is composed of two mandibles furnished with a row of stiff fixed hairs, and of two maxillæ bearing moveable cilia like the blades of a fan and destined to collect the alimentary granules.

The intestinal tube is remarkable from the presence of eight isolated vesiculiform stomachs which are ovoid, thin, arranged symmetrically around the intestine, and each communicating with it by means of a short canal situated at the union of the anterior third with the two posterior thirds of its internal region. These eight cavities represent so many stomachs, and cannot be compared with the respiratory vesicles described by Treviranus, Ramdohr, Carus, Meckel, Owen, Newport and Lacordaire, in several insects belonging to the order Diptera or Lepidoptera. At first sight these gastric cavities are observed to be more or less filled with nutritious matter similar to that perceptible in the remainder of the intestinal tube. These vesicles in fact are seen to contract from time to time and successively, in order to allow the alimentary substance to pass into the intestines. The contractions are repeated at intervals of from twenty-five to thirty seconds; moreover on immersing these insects in liquids coloured with carmine or indigo, the eight stomachs are observed in the course of half an hour or sometimes less to be perfectly filled with these substances; the nature of these organs is consequently beyond doubt.

Although certain observers, as Swammerdam and Leon Dufour, have asserted that several insects ruminate, it cannot be admitted

that in the larva under consideration there is any act which altogether is comparable to what happens among the true ruminant quadrupeds. From their structure however, their physiological action and their development, these multiple stomachs of the gnat call to mind, but on a small scale, what is observed on the 'rumen' and 'reticulum' of the ruminants. In fact their inner membrane is finely alveolated like that of the paunch in these large animals, and the nutriment does not pass by these vesicles as if it were a simple canal, which is generally the case, but it is conveyed into them by a particular passage; it sojourns there for a longer or shorter period, experiences a certain elaboration, and is then expelled by the same passage and re-enters the intestinal tube. The nutriment does not return, it is true, to the mouth, but it undergoes a certain alteration in the stomachs, for the particles partially digested which are perceived in the intestine are considerably thinner than those in the gastric vesicles. In the first periods of life the ruminants feed solely upon milk, there is as yet no rumination in them, and the two first stomachs are then proportionately very small; this is likewise the case in the very young larvæ of the gnat, as they immediately after their issue from the egg absorb a very thin and almost entirely fluid nutriment; these organs are at this period simply rudimentary and perfectly impermeable. The thorax itself which contains them is proportionately much smaller than in larvæ of a greater age.

Thus, if the comparison between the digestive function of the vesicular stomachs of the gnat and the physiological action of the two first digestive cavities of the ruminants is not perfect, however distant these animals are in the zoological scale, yet it cannot be denied that in a local physiological point of view there is rigorous analogy. It is moreover highly worthy of attention that these stomachs are absolutely analogous by their form, their position, and the manner in which they act, to the stomachs of the polygastric Infusoria described by Ehrenberg. This fact adds a fresh proof, although observed upon other animals, of the truth of the investigations of that scientific naturalist.—*Comptes Rendus, Oct.* 25, 1847.

Description and Anatomy of a new and curious subgenus of Planaria. By Joseph Leidy, M.D.

In October 1840, Prof. S. S. Haldeman published a description of an animal under the name of *Planaria gracilis**. Upon examination I detected such a remarkable peculiarity in the digestive apparatus as led me to investigate its anatomy in detail, and to form for it a separate subgenus, characterized as follows:—

Phagocata, oblonga, plano-convexa, nuda, contractilis, mucosa, antica auricularia. Aperturæ duæ, ventrales, ad os et generationem pertinentes. Proboscides multæ.

* Supplement to No. 1 of "A Monograph of the Limniades, or Freshwater Univalve Shells of North America, containing descriptions of apparently new animals in different classes," &c. By S. S. Haldeman. Philadelphia, 1840.

P. gracilis, nigricans, lateribus parallelis, postero acuto abrupte, plerumque antico recto; oculis duobus. Long. 9 lin., lat. 1 lin. Habitat in fontibus Pennsylvaniæ.

Description. Oblong, limaciform, naked, convex superiorly, flat inferiorly, very contractile; sides ordinarily parallel, convex when the animal is in a contracted state, convergent anteriorly when elongated; anterior extremity with a lateral triangular auricular appendage, straight in front, by contraction becoming convex or concave; posterior extremity abruptly pointed; ocelli two, anterior, composed of an oblong, semitransparent (nervous?) mass with an intensely black dot of pigmentum at the internal posterior part; ventral apertures two; oral aperture a little less than one-third the length of the body from the posterior extremity, and very dilatable; generative aperture half-way between the oral aperture and posterior extremity. Colour black or iron gray, and in some younger specimens latericeous.

This animal I have only found in abundance in the neighbourhood of Prof. Haldeman's residence, near Columbia, Pa. In a spring in front of his house, thousands of them may be seen gliding along the bottom; some of them occasionally creep up the sides to the surface of the water, turn upon the back, and by making the ventral surface concave, float about in the manner of the *Limniadæ*. It appears to be carnivorous in habit, or at least it attaches itself to animal matter dead or living, in preference to vegetable matter. When irritated, it throws out a considerable quantity of very tenacious mucus.

In structure it appears to be intermediate between the entozoic *Distomata* and the annulose *Hirudinæ*. I could not detect any trace of annulation, but I think that this alone would hardly be sufficient to place it lower than the latter animals, because, in a closely allied animal, the *Gordius aquaticus*, although there is no annulation in the perfect animal, yet in the embryo state I find it to exist.

The whole animal is composed of a delicate granular structure; the only approach to muscular fibre is in the longitudinal striation of the integument rendered more distinct by the pigmentum nigrum, a radiated appearance around the oral orifice, and a faint transverse and longitudinal arrangement of the granules entering into the composition of the proboscides, seen more or less distinctly in the continued movement of these organs when slightly compressed beneath the microscope.

The digestive cavity presents the same dendritic arrangement as in *Planariæ* generally*, but instead of possessing a single sucker or proboscis, the full-grown animal has not less than twenty-three; varying however in this respect from three upwards, according to the age of the animal. One of these proboscides joins the digestive cavity at the posterior part of the anterior division, as usual; the others join the remaining two divisions at their internal side in their course backwards. They are considerably longer, but narrower, than in *P. lactea*†, and when not in use are closely packed together within the

* Dugès, Ann. Sc. Nat.

† Ib.

animal, so that when the latter is placed beneath the microscope and slightly compressed, they will be seen pressing upon one another in such a manner, that if one changes its position, it will be instantly occupied by another. Those which are formed last are smallest, but they soon gain their full size.

When the animal feeds, the whole of them are protruded from the oral orifice, the longest extending out full one-third the length of the body. As they are all convergent to the same orifice, when fully protruded the animal becomes puckered up and increased in breadth at the expense of the length. In this state the anterior extremity is erected and the posterior brought nearly to a right angle with it, so that it looks as if sitting upon its prey apparently unconcerned, with its proboscides, which writhe and twist about as if they were totally distinct organisms.

If one of these animals be punctured or cut, one or more of the proboscides will be immediately protruded as if they existed under pressure, and will move about in all directions, appearing as if entirely without the control of the animal; or if one of the animals be crushed between two slips of glass so that the proboscides will be torn from their attachment, they move about involuntarily, always in a line forwards or towards the mouth, which they do by contracting the stomachal extremity towards the oral, the latter remaining fixed. In this progressive course they constantly contract and dilate; the mouth opens, and any matter in its vicinity rushes in, when it is closed and the matter passes onwards, and by the alternate contraction and dilatation of different parts of the same tube, it is thrown backwards and forwards several times, and finally violently expelled at the torn extremity. When they have escaped from the ruptures of the tegument produced by crushing, or when snipped off with a pair of scissors whilst an animal is feeding, they will present the same curious phænomena. In fact, these curious independent movements caused me at first to mistake the organs for viviparous young, and it was not until I had frequently observed the animal feeding, and examined its structure beneath the microscope, after having fed them upon coloured food, that I was convinced of their true nature.

Excrementitious matter is expelled from the digestive cavity through the same course by which the food enters.

Circulation.—There appears to be nothing peculiar about the arrangement of the blood-vessels, if such they be; the term being applied to two semitransparent lines passing along each side of the ventral surface, and a third along the middle of the dorsal surface, the three freely communicating with each other by transverse lines and numerous smaller branches, the whole forming an extensive reticulation upon the surface of the body. At the anterior part of each ventral line, I distinctly observed a dilatation to exist.

Generative apparatus.—As in all *Planariæ* the animal is androgynous. The penis is a bulbiform organ placed between the oral and generative orifice, with its point directed towards the latter. The point is straight, or contorted; the bulbous portion is also changeable, sometimes elongated, at others flattened or increased in breadth at

the expense of the length. The bulb shows through the thin integument, and without close examination may be taken for a third orifice. The penis is perforate, and has a dilated cavity within the bulb. Immediately above the penis I indistinctly observed a somewhat lobated organ, which appeared to join the penis at its base by a narrow portion. This is probably the testicle, for it was the only thing I could discover in connection with the genitalia to correspond to it.

In two individuals only could I see part of the female organs. This consisted in two sigmoid tubes or oviducts, which could be traced from the generative orifice a short distance forwards, one on each side of the penis.

I could detect no traces of a nervous system.

The eyes, so called, have been previously described. It is still a question with many, whether these, as well as the corresponding deep black points existing in very many of the lower animals of the invertebrate series, subserve the purpose of eyes ; and some anatomists have even gone so far as to deny the sense of sight to the comparatively perfect eye of many gasteropodous mollusca. The experiments which are made to test the existence of this sense in these organs for the most part are exceedingly fallacious, generally being performed by concentrating the light upon them through a lens. Insects, and even serpents and frogs, I find will frequently bear the impression of a sudden glare of light produced in this way without any inconvenience, at other times they will seek to avoid it; but *Helix albolabris* will occasionally retract its tentacle when so disturbed, and *Phagocata* will frequently raise its anterior extremity and move from the too great light. From their position, which is always such as to be well exposed to the influence of the light; from their structure, imperfect as it is in many cases, and their connection with the nervous system when this exists, I am led to conclude that in all cases they are organs of vision.

The general sensibility of *Phagocata* is very considerable, that is, it contracts with great readiness from the slightest disturbance. The contraction has much the appearance of being involuntary, and is very like that of the *Medusæ*. When an individual is irritated at any point, contraction commences there, and thence rapidly extends throughout the animal, and the only appearance of volition is in the effort to escape ; but if the touch be too rude, apparently involuntary contraction takes place suddenly, and appears to destroy all power of volition for the moment ; the animal however soon revives from this state and glides off with its accustomed speed.

Some experiments which I performed upon *Phagocata* confirm the statements that the *Planariæ* are capable of repairing injuries. When an individual is cut into two, both parts after a time become distinct and perfect animals. Division carried to a greater extent in some instances results in as many perfect animals as there are parts, but generally I have found that when cut into more than three or four pieces, the intermediate pieces are apt to die, and sometimes the extremities do not survive.—*Proc. Acad. Nat. Scien. Philadelphia.*

BASILOSAURUS.

The following is an extract from a letter from Prof. J. Müller to Mr. A. Retzius, dated Berlin, March 24, 1847 :—

"The *Hydrarchus*, Koch, found in the tertiary formation in Alabama, is identical with Harlan's *Basilosaurus* and Owen's *Zeuglodon cetoides**. The crowns of the teeth, with which Owen was not acquainted, have a great resemblance to those of the Seal; in the maxillary teeth they are cutting and many-pointed; most of the maxillary teeth have double roots, but the anterior has, as in the Seals, only a single root. In the anterior part of the jaw are found conical curved teeth, viz. an incisive and a canine, at least this is the case with the under jaw.

"As such teeth as those which are found in the *Hydrarchus* occur in the tertiary formation in Malta, we may conclude that this animal belongs likewise to the tertiary formation of that island.

"I think I can positively show that the *Hydrarchus* is not a reptile, but a mammal belonging to a peculiar extinct family. It has the ear formed as in the mammals, viz. a helix and a tympanic bone as in the Whales. It has moreover two occipital condyles, and in the whole formation of the cranium no trace of reptile structure occurs, but on the contrary everything is as in mammals.

"The vertebral column is very peculiar in its structure. The cervical vertebræ, probably more numerous than in any other mammal, are without perforations in their transverse processes; the ribs are only attached to the transverse processes of the vertebræ; at the central and posterior part of the column the bodies of the vertebræ are unusually long, and must both at the anterior and posterior part of the extremities have been cartilaginous, inasmuch as we find here beneath the bony shell a mass of pure stone, while the central part of these vertebræ consists wholly of bone."—*Silliman's Journal for Nov.* 1847.

Additional Note on a paper on Porcupines. By J. E. Gray, Esq., F.R.S. &c.

In my former paper† I was unable to give the country of *Acanthion Cuvieri*. Mr. Frazer has since brought a skull and two living specimens of this species from Algiers; the latter are now in the Gardens of the Society, and Mr. Whitfield has brought others from the Gambia. In the number of the Journal of the Asiatic Society of Calcutta for August 1847 just arrived (p. 772. t. 32), I observe that Mr. Hodgson has described a new species of Indian Porcupine under the name of *Hystrix alopæus*, called *Ancholia* by the natives, which is certainly an *Acanthion*, and most probably my *A. Hodgsonii*; if so, the latter name will have the priority, as having been published in July.—*From the Proceedings of the Zoological Society, Nov.* 9, 1847.

* *Phocodon*, Agassiz. *Squalodon*, Grateloup, in Leonhard and Bronn's Jahrbuch für Mineralogie, 1841, p. 830.

† Ann. Nat. Hist. vol. xx. p. 349.

METEOROLOGICAL OBSERVATIONS FOR JAN. 1848.

Chiswick.—January 1. Foggy: hazy: sleet-showers. 2. Very fine. 3. Densely overcast: cloudy and mild. 4. Exceedingly fine: clear. 5. Overcast: rain: clear. 6. Slight frost: clear: fine. 7. Slight frosty haze: heavy rain: clear. 8. Hazy. 9. Frosty: overcast. 10. Overcast: dusky clouds and cold. 11. Uniformly overcast, with dusky haze. 12. Overcast: slight rain. 13. Clouds tinged with red: overcast: rain. 14. Hazy: drizzly. 15. Cloudy: exceedingly fine, with bright sun: frosty. 16. Sharp frost: very fine: clear and frosty. 17. Rain. 18. Fine. 19. Cold easterly haze. 20—22. Densely overcast. 23. Slight snow. 24. Low fleeting clouds from N.E. 25. Cold dry easterly wind: densely overcast. 26. Dusky haze: clear and frosty. 27. Frosty. 28. Snowing: clear and frosty: snow in the evening. 29. Foggy: fine: clear. 30. Overcast: rain. 31. Densely and uniformly overcast: sleet.

Mean temperature of the month	33°·62
Mean temperature of Jan. 1847	34 ·26
Mean temperature of Jan. for the last twenty years	36 ·51
Average amount of rain in Jan.	1·59 inch.

Boston.—Jan. 1. Cloudy: rain early A.M. 2. Cloudy: rain A.M. and P.M. 3. Cloudy. 4. Fine. 5. Cloudy. 6. Fine. 7. Cloudy: snow A.M. 8. Cloudy: snow on the ground. 9. Fine: snow on the ground. 10, 11. Cloudy: snow on the ground. 12. Fine. 13, 14. Cloudy. 15. Fine: rain early A.M. 16, 17. Fine. 18. Fine: rain early A.M. 19, 20. Fine. 21. Cloudy: snow early A.M. 22, 23. Cloudy. 24—27. Fine. 28. Cloudy. 29. Cloudy: snow A.M. and P.M. 30. Cloudy: snow and rain P.M. 31. Fine: rain P.M.

Applegarth Manse, Dumfries-shire.—Jan. 1. Frost: cloudy P.M. 2. Thaw and rain. 3. Thaw and rain: snow gone. 4. Rain A.M.: cleared: rain P.M. 5. Heavy rain all night: flood. 6. Frost: cloudy P.M. 7. Frost, slight: sprinkling of snow. 8. Frost, slight: drizzle P.M. 9. Frost, slight: harder P.M. 10. Frost, rather hard: snow. 11. Frost: fog all day. 12. Thaw: soft wind: snow gone. 13. Remarkably fine: frost P.M. 14. Air moist: rain P.M. 15. No frost: showers and wind P.M. 16. Showery early A.M.: cleared. 17. Frost, severe: slight snow. 18. Frost: clear: keen. 19. Frost: clear and fine. 20. Frost, severe: clear. 21. Frost: cloudy: threatening change. 22. Frost: no change: clear. 23. Frost: beautiful winter day. 24. Frost, keen: clear and fine. 25. Frost: threatening change. 26, 27. Frost: severe weather. 28. Frost: snow inch deep. 29. Frost A.M.: rain P.M. 30. Frost: heavy snow five inches deep. 31. Frost: clear.

Mean temperature of the month	33°·8
Mean temperature of Jan. 1847	35 ·9
Mean temperature of Jan. for twenty-five years	34 ·9
Rain in Jan. for twenty years	2·60 inches.

Sandwick Manse, Orkney.—Jan. 1. Cloudy: clear. 2. Showers: rain. 3. Cloudy. 4. Clear: cloudy. 5. Cloudy: rain: cloudy. 6. Clear: cloudy. 7. Cloudy: rain: cloudy. 8. Showers: cloudy. 9. Bright: frost: cloudy. 10. Rain. 11. Bright: rain. 12. Damp: drizzle. 13. Drizzle. 14. Drizzle: showers. 15. Sleet-showers: clear. 16. Bright: showers. 17. Bright: frost: cloudy: frost. 18. Bright: frost: clear: frost. 19. Bright: frost: cloudy frost. 20. Clear: frost. 21. Bright: frost: cloudy: frost. 22. Cloudy. 23. Snow: clear: aurora. 24. Bright: clear: aurora. 25. Clear: aurora. 26. Bright: frost: clear: aurora. 27. Bright: clear. 28. Cloudy: frost: snow-drift: aurora.: 29. Clear: frost: thaw. 30. Bright: frost: clear: aurora. 31. Bright: frost: clear: frost.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.								Wind.				Rain.			
	Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.									
1848. Jan.	Max.	Min.		9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9½ a.m.	8½ p.m.	Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1.	29·846	29·807	29·57	29·65	29·59	29·77	29·73	42	29	34	35	24½	39	37½	se.	se.	se.	sse.	·22	·14	......	......
2.	29·831	29·783	29·52	29·50	29·40	29·56	29·46	49	38	35	39½	33	40	42	sw.	se.	ese.	sse.	·01	......	......	·12
3.	29·919	29·845	29·51	29·42	29·50	29·33	29·40	51	41	48	51	37½	46	48	s.	s.	se.	ssw.	......	·11	......	·29
4.	29·974	29·817	29·63	29·65	29·49	29·66	29·40	49	27	44	48½	42½	38	45	se.	s.	s.	sse.	......	......	......	......
5.	29·641	29·542	29·34	29·29	29·38	29·34	29·38	46	24	41	48	40	43	41	sw.	s.	sw.	ssw.	·08	......	......	......
● 6.	29·799	29·719	29·42	29·66	29·60	29·72	29·54	40	26	31	35	27	35	40	n.	w.	sw.	se.	......	......	......	·09
7.	29·591	29·478	29·25	29·27	29·36	29·30	29·41	40	27	33	39	31½	39	38½	sw.	s.	sw.	se.	·21	......	......	......
8.	29·724	29·570	29·33	29·46	29·80	29·78	30·06	38	29	32	38	31½	39	39	sw.	calm	ne.	ese.	·02	......	1·46	·32
9.	30·190	30·005	29·84	30·05	30·10	30·16	30·09	33	28	33	37	34	38	36	ne.	e.	ne.	sse.	......	......	......	·02
10.	30·277	30·219	29·96	30·09	30·07	30·00	29·90	32	29	33	35	28	39½	41½	e.	e.	se.	wnw.	......	......	......	·12
11.	30·461	30·268	30·07	30·27	30·35	30·25	30·19	37	24	31·5	35	31	43	45	ne.	w.	sse.	w.	......	......	......	·68
12.	30·433	30·331	30·06	30·23	30·28	30·17	30·21	44	29	35	47½	31	47½	46½	sw.	w.	w.	w.	·01	......	......	·20
☽ 13.	30·311	30·293	29·98	30·30	30·27	30·37	30·26	42	39	42	45½	40½	45	45	n.	nnw.	nw.	w.	·08	......	......	·07
14.	30·228	29·963	29·87	30·10	29·72	30·01	29·56	45	36	40·5	45	31	46	40	nw.	nw.	sse.	nw.	·06	......	......	·10
15.	29·986	29·904	29·60	29·88	29·85	29·75	29·78	42	20	36·5	44	30½	40	39½	n.	nnw.	nw.	w.	......	·51	......	·26
16.	29·972	29·841	29·64	29·73	29·42	29·50	29·24	38	28	31	42	32½	42	41	w.	w.	ssw.	ssw.	·04	......	0·38	......
17.	29·630	29·328	29·26	29·21	29·23	29·22	29·32	44	29	36	42½	34	35	33½	sw.	w.	se.	sse.	·23	......	......	·06
18.	29·461	29·306	29·14	29·20	29·15	29·25	29·37	38	27	31	34½	24	35	36	sw.	w.	ese.	sse.	......	......	......	......
19.	29·643	29·399	29·20	29·39	29·60	29·56	29·69	35	29	34	36½	29½	35½	36	e.	e.	e.	s.	......	......	......	......
○ 20.	29·882	29·807	29·54	29·74	29·95	29·90	30·05	35	30	32	32	22	36	34	ne.	nne.	nne.	s.	......	......	......	......
21.	30·131	30·073	29·82	30·06	30·06	30·04	29·96	32	30	34	34½	20	36	37	ne.	e.	ne.	s.	......	......	......	......
22.	30·081	30·010	29·75	29·94	29·87	29·82	29·83	33	28	32	33	31	38	35½	ne.	e.	e.	s.	......	......	......	......
23.	30·283	30·091	29·83	30·02	30·27	30·12	30·35	35	29	31	35½	28½	35	31	ne.	e.	nne.	calm	......	......	0·00	·28
24.	30·358	30·338	30·11	30·38	30·41	30·43	30·42	37	29	34	38	27	37	38½	ne.	n.	ne.	ssw.	......	......	......	......
25.	30·370	30·242	30·14	30·40	30·33	30·41	30·41	32	25	33	36	25	38½	38	ne.	n.	ne.	calm	......	......	......	......
26.	30·038	30·072	29·90	30·18	30·06	30·35	30·29	27	20	31·5	37	27	35	37	e.	ene.	ene.	sse.	......	......	......	......
27.	30·134	29·953	29·83	30·05	30·08	30·33	30·37	31	19	30	37	30	39	36	e.	e.	e.	se.	......	......	......	......
☾ 28.	30·195	30·182	29·63	29·83	29·72	30·23	29·90	29	17	21	32	25	35	29	e.	e.	e.	ese.	·06	......	......	·05
29.	30·094	29·749	29·66	29·75	29·40	29·85	29·62	44	28	33	35½	11	25	37	s.	e.	e.	se.	·02	......	......	......
30.	29·856	29·712	29·30	29·33	29·00	29·26	29·13	48	36	36	37	32½	35½	35	s.	se.	ene.	wsw.	·12	......	0·50	·14
31.	29·854	29·817	28·97	29·10	29·37	29·16	29·42	39	28	34	36½	22½	35½	31	ne.	s.	n.	n.	·13	·57	......	......
Mean.	30·000	29·886	29·63	29·778	29·763	29·825	29·798	38·93	28·32	34·3	38·7	29·9	38·41	38·38					1·29	1·33	2·34	2·80

THE ANNALS

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XXIV.—*Descriptions of* Aphides. By Francis Walker, F.L.S.

Yet e'en decay and darkness have their world!
Nothing is lost,—nothing forsaken here:
In dull rank weeds unnumber'd hosts lie curl'd—
Root, branch, stem, flower, have each their insect sphere;
E'en darkness hath its population drear;
Each turf impregnate with existence heaves!—
More countless metamorphoses appear—
More marvels haunt our feet than thought conceives,
While worlds of insect tribes hang quivering on the leaves.—*Swain.*

La providence, en livrant l'homme à lui-même, l'a placé sous une grande et redoutable responsibilité. Si l'étude de l'histoire naturelle n'avoit servi qu'à prouver cette vérité, elle auroit atteint le but le plus noble dont les sciences puissent s'enorgueillir, celui de tendre à améliorer l'espèce humaine par les exemples qu'elle nous propose.—*Huber.*

This communication, instead of being introduced with remarks on the family of Aphides or on the authors who have noticed them, begins with particular observations and specific descriptions as a groundwork for generalities, and as a means of gradually unfolding the history of these insects, and of gathering matter for satisfactory conclusions thereon.

First Group.

This comprises the two following species, and is characterized by some parts of their structure, such as the great length of the nectaries and of the last joint of the feelers, by their being scattered and not clustering on their habitation, and by their three forms, which are—

1. *The viviparous winged female.*

The name of this form indicates one of the peculiarities of Aphides, nearly all other insects being oviparous, and its individual power of self-reproduction is a still more remarkable property. This continual renewal, whose period may in some cases

be lengthened by art, would in time wear out the species, as the skin-shedding or the change of form (both which acts seem to typify or to resemble the first-mentioned process) tends to exhaust the insect, were not such a casualty provided for by the appearance of the second form after the lapse of a few generations of the winged female.

2. *The oviparous wingless female.*

The viviparous Aphides produce oviparous females and males at different times of the year, but in most species the first appearance of the two latter forms is autumnal. The law which thus ordains an alteration of form may be compared to that which adjusts the relative proportions of the foliage, flowers, and seeds of plants to the conditions of the soil and of the atmosphere; and these two agents bear the same relation to vegetation as the latter does to Aphides with respect to inducing a change of structure.

3. *The winged male,*

whose appearance in the two following species precedes the fall of the leaf where it dwells, and then its partner, the oviparous female, lays the eggs which by their glutinous covering are fastened to the twigs, and thereby secured from injury during the winter till the first mild weather in the spring recalls the species to active life.

1. *Aphis Platanoidis.*

Aphis Platanoidis, Schrank, Fauna Boica, ii. 1. 112; Kaltenbach, Mon. Pflan. i. 13; Ratzeburg, Forst. Ins. iii. 216. t. 11. f. 4; Hartig, Germ. Zeit. iii. 369.

Aphis Pseudo-platani, Sir Oswald Mosley, Gardener's Chronicle, i. 684.

It feeds on *Acer Pseudo-platanus,* the sycamore; *A. Platanoides,* the plantain-like or Norway maple; and sometimes on *A. campestre,* the field maple, and is stationed on the under side of the leaf.

The viviparous winged female. This is hatched from the egg in February or in March, and while young or a pupa it is slender, pale green, rather flat and hairy, and adorned along the back with four rows of black dots, with two vivid green stripes, and with two rows of projections, which are separated by three rows of smaller tubercles; these and the hairs diminish or disappear during the growth of the insect: the limbs are dull green: the feelers are stout, and rather shorter than the body; their joints have black tips: the eyes are black: the tip of the mouth is brown: the nectaries in the very young insect are not more than one-twelfth of the length of the body: the legs are short and stout.

1st variety. Green, with two dark green stripes along the back. 2nd var. White, with two bright green stripes along the back. 3rd var. Whitish green. 4th var. Pale green. 5th var. Dark green. 6th var. Yellowish green. 7th var. Yellow. 8th var. Pale red. 9th var. Dark red. 10th var. Nearly black. 11th var. With a broad pale stripe on each shank, and a narrower band at the base of each thigh.

The wings are unfolded soon after the middle of April, or somewhat later; the insect is then long, slender, active, rather flat, and of a bright yellowish green colour: the breadth of the head is about twice its length; there are two impressions near together on its disc: the forehead is concave, and has a slight protuberance on each side: the feelers are slender, setaceous, brown, green at the base, and a little longer than the body; the first and the second joints are very short, and the former is thick; the third is very long; the fourth is much shorter than the third; the fifth is thick at the tip, and nearly as long as the fourth; the sixth is obclavate, and about one-fifth of the length of the preceding joint; the seventh is much more slender than the fifth, which it equals in length; it is sometimes reddish brown: the eyes are bright red, and behind each of them there is a small detached lobe which supports a few facets like those of the proper eye; this structure and the form of the chest are common to the genus: there are three eyelets on the crown; one in the middle and in advance of the other two: the mouth is pale yellow with a brown or a black tip, and just reaches the base of the middle legs; it is the sheath of three very slender bristles which are put forth to pierce the plant when the insect sucks: the fore-chest is large, angular, and well-developed; its breadth is about twice its length; it has four furrows, and of these the two inner converge towards the fore-border and the two outer towards the hind-border: the middle chest is smooth and shining; its lobes and the disc of the breast are brown; the corselet has a triangular lobe in front and another behind, and an irregularly-oval lobe on each side; the scutcheon is short-obconical: the abdomen is spindle-shaped, slightly convex, not shining, and is furnished with a few hairs: the nectaries are seated on each side of the hinder part of the abdomen; their tips are brown, and they are as long as one-fourth or as one-fifth of the body. Mr. Haliday has favoured me with the following information respecting these organs, through which the Aphides pour forth streams of honey:—"It appeared to me that the row of spiracles send off internally from each a delicate membranous tube without the spiral coil, but soon ramifying into the ordinary tracheæ, and that the nectary is not the regular spiracle of the segment in which it is placed, but that this is also present a little lower and more forward, and that the nectary is

an organ of the same system sending inwards and inclined a little down a similar tube. The summit of the nectary is contracted and then expanded again in a sort of lip, thus acting as a sphincter." The legs are pale green, long and slender; the fore-thighs are stout, and each has a small obtuse tooth on the inner side of its tip; the knees, the feet, and the tips of the shanks are brown; the shanks are hairy, longer and more slender than the thighs; the feet have two joints; the first is very short, the second is longer and furnished with claws: the wings are colourless and much longer than the body; the wing-ribs and the wing-brands are green; the veins are brown, and their tips are slightly clouded: the fore-wing has a strong rib-vein running parallel to and a little below its fore-border; four branch-veins spring from it; the first and the second pass to the hind-border of the wing; the third is divided at about one-third of its length; one branch joins the hind border, the other is again forked, and the upper part of the fork runs to the tip of the wing; the fourth or radial vein is short and curves upwards: the lower wing has a rib-vein that runs very near the fore-border, and sends forth two simple veins to the hind-border.

1st variety. The lobes of the middle chest and the disc of the breast are black. 2nd var. With a row of transverse black spots along the back of the abdomen: the legs are pale yellow; the knees, the feet, and the tips of the shanks are black: the wing-ribs and the rib-veins are yellow. 3rd var. The disc of the head, two spots on the fore-chest, and the middle chest are black: the feelers are black and covered with a white bloom; their base is dull yellow. 4th var. The body is tinged with bright red. In the 5th var. the disc of the head and the middle chest are green, in the 6th they are buff, in the 7th they are red, in the 8th they are lilac. 9th var. The body is deep black; the head is tawny. 10th var. The whole body is covered with a white bloom. 11th var. The body is pale red, or rust-colour: the back of the abdomen is traversed by a row of short black bands: this variety occurs chiefly in the autumn. 12th var. The wing-brand is colourless.

Sometimes one hundred of these insects may be seen under a single leaf, and innumerable swarms hover about the sycamore-trees during the fine calm autumn evenings. In this season it still continues to bring forth young ones, which the fall of the leaf soon carries away to the earth, where they perish. When it abounds, a great variety of insects, especially of Hymenopterous and of Dipterous flies, come to feed on its honey-dew; this matter stops the pores and hastens the decay of the leaf, which towards the end of autumn is often covered with little Acari, the devourers of the dead Aphides. This honey falling on the upper surface of

the leaf assumes a sooty appearance, and the presence of the Aphis has been supposed to promote the growth of *Xyloma Acerinum* on sycamore-leaves, but the appearance of this black shining fungus seems to be occasioned by the soil and the local situation of the tree. This Aphis is devoured by the *Coccinellæ* or lady-birds, by the larvæ of the *Hemerobii* or lace-winged flies, and of the *Syrphidæ* or hawk-flies; it is carried by the *Crabronidæ* to their nests, and is there stored up as provision for the larvæ. Its internal destroyers are *Aphidius constrictus,* a species of *Allotria, Megaspilus Carpenteri, Asaphes ænea, Cyrtogaster vulgaris, Coryna clavata,* and *Encyrtus Atheas. Coccinella 7-punctata,* the common lady-bird, was unusually abundant on the sycamore-trees in the autumn of 1847; the beetle was of frequent occurrence in the spring, and the grubs of the succeeding generation were exceedingly numerous, and attracted public attention when they assumed the final state.

The dark colour of Aphides appears first on the tips of the feelers and on the tip of each of their joints, on the tip of the mouth, on the head, the chest, the breast, and on the back of the abdomen, on the tips of the nectaries, on the feet, and on the tips of the shanks and of the thighs, and thence spreads more or less over the rest of the body and of the limbs. When the skin has been just shed, the body is pale and the limbs are white.

The preparations of these insects in Canada balsam present a view of the internal organization, and of the parasitic larva which lies in the abdomen in a curved position, and by appropriating to itself the food received by the parent hinders the formation of the young ones, of which the winged female is rather more prolific than is the wingless female with regard to eggs. The Aphis when very young, and some time before birth, appears to consist of an almost homogeneous yolk, and resembles the egg, but is much smaller.

The oviparous wingless female. This form attains its full growth in the beginning of October, and is distinguished by the long tail-like part of the abdomen behind the nectaries; it is yellow, and has a vivid green stripe on each side of the back: there are a few black spots along the middle of the abdomen, and some short black streaks near its tip: the feelers are a little shorter than the body.

1st variety. Very dark green, traversed by black bands: the tip of the abdomen is dull yellow, slightly streaked with black. 2nd var. Almost black. 3rd var. Pale yellow, with a fine rose-colour towards the head, and along each side of the body and about the tip of the abdomen. 4th var. Green. 5th var. Yellow. 6th var. Buff. 7th var. Pale orange. 8th var. Brown.

It lays its eggs during November on the buds and on the shoots

of the sycamore. The eggs are spindle-shaped, and very large in proportion to the size of the mother; when newly laid they are pale, but they soon become black and shining, and have much resemblance in size, shape and colour to the eggs of most other species of *Aphis*. I have not seen more than twelve eggs in the body of a single insect, and the number is usually much less; the egg lies lengthwise along the body, and by preserving the Aphides in Canada balsam the process of its formation is seen, and it may be ascertained to be homogeneous, and not a mere envelope for the young Aphis, as some authors have conjectured. An egg sometimes occurs in the fore-chest, but its presence there is probably accidental.

The winged male. Unfolds its wings in the beginning of October; it is darker than the winged female, and has more numerous marks on the chest and on the abdomen, and its wing-brands are also of a darker colour. It is brownish yellow: the head, the disc of the chest, and that of the breast are brown: the head is a little broader than the chest: the abdomen is brown and linear, and has a broad pearly whitish green stripe on each side: the feelers are thick towards the base, and longer than the body: the nectaries are dull pale yellow, brown at the base, and as long as one-fourth of the body: the thighs except the base, and especially the hind-thighs, are somewhat darker than the shanks. In the fore-wing of one fly the lower vein of the first fork, instead of proceeding to the hind-border of the wing, curves backwards and joins the second vein at a short distance from its tip. It pairs with the wingless female from the middle till the end of October.

1st variety. Black in such parts where this sex is usually brown.

In this species, as in other Aphides, the union of the branch-veins with the rib-vein is usually more or less imperfect, and this variableness occurs even in the opposite wings of one fly, but the junction is in some cases fully effected. The seventh joint of the feelers has occasionally but little more than half its usual length.

Length of the body 2 lines; of the wings 4 lines.

2. *Aphis Acerina*, n. s.

I observed this insect near London from the beginning of July till the end of October 1847, feeding on the leaves of two young sycamore-trees (*Acer Pseudo-platanus*) that were about five feet high, and were situate a mile apart from each other, one in a garden, the other in a wood. It is a very lively, active and elegant species.

The viviparous winged female. Its body is of a bright lemon-colour: the feelers are yellow, and very much longer than the body; the tips of their joints are brown; the third joint is very

long; the fourth is a little shorter than the third; the fifth is a little shorter than the fourth, and very slightly dilated at the tip; the sixth is spindle-shaped, and from one-fifth to one-sixth of the length of the fifth; the seventh is longer than the fifth: the mouth is pale yellow; its tip is brown: the eyes are red: the disc of the chest and that of the breast are brown; the sides of the chest are pale brown: there are two dark brown bands across the middle of the disc of the abdomen, and two dots of the same colour between the hindermost band and the nectaries; these are brown, and more than one-fourth of the length of the body, and at the base of each there is a small black spot: the legs are yellow and slender; the fore-thighs and the hind-thighs are shaded with brown; the knees and the tips of the feet are black; each fore-thigh has a very slight tooth on the inner side of its tip: the wings are colourless, and much longer than the body; the wing-brands are very pale; the veins are buff, and in form are alike to those of *A. Platanoidis.*

1st variety. The feelers are nearly twice the length of the body.

2nd var. The seventh joint of the feelers is not longer than the fifth.

The number of young in the body does not usually amount to twelve; they are occasionally more numerous, but in that case some of them are extremely small. This female is the prey of a species of *Aphidius.*

The oviparous wingless female. This is spindle-shaped, and in form much resembles the oviparous *A. Platanoidis*; it occurs from the beginning till the end of October. Its colour is buff or yellow; the tips of the joints of the feelers, the tip of the mouth, the lobes of the chest, the tips of the nectaries, the knees, and the feet are brown; there are also five or six interrupted brown bands across the abdomen, increasing in distinctness till the last, which is usually entire: the eyes are dark red.

1st variety. The tips of the joints of the feelers, the knees and the feet are black.

The winged male. Much resembles the winged female, but is somewhat darker; it pairs with the oviparous female before the end of October.

Length of the body $1\frac{1}{2}$ line; of the wings 3 lines.

Second Group.

Like the first group, but the nectaries hardly rise above the surface of the abdomen, and the seventh joint of the feelers is shorter than the sixth.

3. *Aphis Betulæ.*

Aphis Betulæ, Linn. Syst. Nat. ii. 735. 21; Faun. Suec. 992; Fabr. Sp. Ins. ii. 386. 20; Ent. Syst. iv. 215. 25; Syst. Rhyn.

297. 25; Gmelin, Syst. Nat. i. 2206; Reaum. Ins. iii. t. 22. f. 2; Schrank, Fauna Boica, ii. 1. 110; Geoff. Ins. i. 496. 7; DeGeer, Ins. iii. 45. 3. f. 27, 28; Kalt. Mon. Pflan. i. 144. 118.

Aphis nigritarsis, Heyden, Mus. Senkenberg. ii. Heft 3. p. 299; Kalt. Mon. Pflan. i. 135. 103.

Aphis punctipennis ?, Zetterstedt, Faun. Lapp. i. 559. 4; Ins. Lapp. i. 2. 311. 7.

This large and handsome species may often be seen flying about birch-trees during the summer and the autumn; it has some resemblance to *A. Platanoidis*, but the successive generations are more variable both in structure and in colour, and local differences also occur. Zetterstedt's *A. punctipennis* inhabits the birch and the alder, and has been found in Lapland and in Greenland.

The viviparous winged female. This appears before the middle of April on the leaves of the white birch-tree, *Betula alba*; while a pupa it is narrow, long, linear and bristly, and of a bright grass-green colour: the feelers are not more than half the length of the body: the legs and the rudimentary wings are pale green, and there is a spot of the same colour at the base of each nectary. The wings are unfolded before the end of April, and the insect is then of a grass-green colour, and often quite covered with a white bloom: the crown of the head bears two impressions, and in front it is rather narrow and nearly straight, but there is a slight protuberance at the inner base of each feeler: the feelers are black and shorter than the body; the fourth joint is much shorter than the third, but much longer than the fifth, whose tip is very slightly dilated; the sixth is also slightly dilated at the tip, and is nearly half the length of the fifth; the seventh is rather more than half the length of the sixth: the eyes are dark red: the mouth is black, green towards the base, and hardly reaches the middle hips: the chest has a slight tawny tinge; its disc is nearly black, and it has a dark spot on each side: the breast is black: there are six rows of black tubercles along the back of the abdomen: the nectaries have black tips, and are less than one-twentieth of the length of the body: the legs are dull green, rather long and stout; the thighs are somewhat paler towards the base; the feet and the tips of the shanks are brown: the wings are colourless, and longer than the body; the wing-ribs and the rib-veins are pale yellow; the wing-brands are rather darker; the veins are brown, and their tips are slightly clouded.

1st variety. The pupa. Bluish green.

2nd variety. The pupa. Yellowish green, especially towards the head.

3rd variety. The pupa. Dark green.

4th variety. The pupa. Blackish.

5th variety. The disc of the head is nearly black: the legs

are black: the black spots on the abdomen are confluent and form bands.

6th variety. Pale green; the tips of the feelers are gray; the sixth joint is longer than the fifth, and the last character is common to this female during the summer and the autumn: the feet and the tips of the shanks are black: the wings are much longer than the body. In the middle of June.

7th variety. The pupa is pale yellowish green: the winged insect is bright yellow, and often thickly covered with white bloom: the middle chest and the middle breast are buff: the feelers are black and longer than the body, at the base they are pale green or pale yellow, and the latter colour sometimes extends along their whole length with the exception of the tip of each joint: the mouth is pale green or pale yellow; its tip is black: the legs are pale yellow; the knees, the feet, and the tips of the shanks are black; the thighs are sometimes pale green with black tips. In the beginning of July.

8th variety. Like the preceding, but with a black stripe on the middle of the head, and a black spot on each side: there is also a brown stripe along the fore-chest: the middle chest and the middle breast are black.

9th variety. Like the preceding, but the middle chest is red, and its disc is black: there are two large oblong-quadrate deep black spots on the back of the abdomen.

10th variety. The pupa is pale yellowish green, or pale yellow with irregular lively green spots along each side of the abdomen: the chest of the winged insect is tawny, and marked with black, and there is a large irregular subquadrate black spot on the middle of the abdomen. At the end of August.

11th variety. Yellow: the head and the fore-chest are green, and each of them has a black line along its hind-border: the middle chest and the wing-ribs are orange; the shield is black, and there are two or three black spots on the back of the abdomen: the wing-brands are pale yellow.

12th variety. Like the preceding, but the middle chest and the middle breast are bright flesh-colour and marked with black: the whole of the wing-border is orange.

13th variety. The pupa is bright orange: the head, the fore-chest and the limbs are pale yellow: the eyes, the tips of the feelers and the tip of the mouth are black. In the beginning of October.

14th variety. The body is of a dark colour: the feelers are much shorter than the body, and sometimes not more than half its length: the wings are also short. At the end of May.

There are other but less distinct varieties.

On the front of the pupa there are bristles, which disappear

in the winged insect. The young ones in the pupa or in the winged insect sometimes exceed thirty in number, but are then of various sizes; sometimes they are of large size and only four in number. It is devoured by the grubs of *Coccinellæ, Hemerobii, Chrysopæ* and *Syrphi*.

The oviparous wingless female. Appears in the autumn and lays its eggs during the latter part of October and in the beginning of November, when it sits on the leafless bough. It is brown with black bands: the feelers are black and shorter than the body: the mouth is dull yellow; its tip and the nectaries are black: the eyes are dark red: the legs are yellowish brown: the hind part of the body is lengthened like that of *A. Platanoidis*.

1st variety. Green.

2nd variety. Dusky yellow, or dull reddish yellow: every segment has a brown line across the disc, and another along each side border: the legs are dull yellow; the knees are brown; the feet and the tips of the shanks are black.

The winged male. It pairs with the wingless female at the end of September: it is darker than the winged female, and like it is sometimes covered with a white bloom: the head and the chest are mostly black, and there is a compact row of large black spots along the abdomen: the feelers are longer than the body: the mouth is short, and reaches a little beyond the hind-border of the fore-chest.

Length of the body $1\frac{3}{4}$—$2\frac{1}{2}$ lines; of the wings 4—$5\frac{1}{4}$ lines.

4. *Aphis comes.*

This insect is of rare occurrence, and has much resemblance to *Aphis Betulæ*.

The viviparous winged female. Found on the birch, *Betula alba*, in August and in October. The body is yellowish brown, and rather long: the front of the head is rather narrow and nearly straight, and there is a slight protuberance at the inner base of each feeler: the feelers are black, setaceous, slightly hairy, and much shorter than the body; the first and the second joints are yellowish; the fourth is much shorter than the third; the fifth is much shorter than the fourth; the sixth is not half the length of the fifth; the seventh is a little shorter than the sixth: the mouth is yellow, and reaches to the middle hips; its tip is black: the eyes are dark red: the disc of the chest and that of the breast are black: the abdomen has two black spots on each side: the nectaries are extremely short, and like those of *A. Betulæ*: the legs are brownish yellow, long, and somewhat hairy; the feet, the knees, and the tips of the shanks of the fore-legs and of the middle legs, and the whole of the hind legs excepting the base of the thighs, are black: the wings are colourless; the wing-

ribs, the wing-brands and the veins are tawny; the fourth branch-vein sends forth its first fork at one-third, and its second fork at two-thirds of its length. The young ones in the body sometimes amount to thirty in number, of which a third part are large and the rest are small.

1st variety. With four black spots on each side of the abdomen.

Length of the body 2—2½ lines; of the wings 5—6 lines.

Third Group.

The only species in this group differs not from *A. comes* in structure, but in addition to the three forms before-mentioned it has a fourth, which is the viviparous wingless female.

5. *Aphis oblonga.*

Aphis oblonga, Von Heyden, Stet. Ent. Zeit. Jahr. v. 12; Kalt. Mon. Pflan. i. 144; Ratz. Forst. Ins. iii. 219; Stet. Ent. Zeit. 1844, pp. 9, 81, 133, 410.

The viviparous wingless female. The body is brown: the front of the head is slightly concave: the feelers are black, setaceous, slightly hairy, and shorter than the body; the fourth joint is pale yellow at the base, and about half the length of the third; the fifth is also pale yellow at the base, and a little shorter than the fourth; the sixth is much shorter than the fifth; the seventh is much shorter than the sixth: the eyes are dark red: the mouth is black, yellow towards the base, and reaches to the middle hips: the nectaries are shorter than those of *A. comes*, and do not rise above the surface of the abdomen: the legs are dark yellow and slightly hairy; the thighs, excepting the base, the feet, and the hind shanks, are black. It is the prey of a parasitic grub.

The viviparous winged female. In colour like the preceding form, but the disc of the chest and that of the breast are black: the wings are colourless; the wing-ribs, the wing-brands and the veins are tawny; the second fork of the fourth branch-vein is rather long.

Length of the body 1¼ line; of the wings 3 lines.

I am indebted to my friend Mr. Haliday for the following translation of an extract from 'Erichson's Bericht,' &c., 1844:—

"Ent. Zeitung, pp. 9, 81, 133, 410. Ratzeburg observed a species of *Aphis* on the birch which continued to produce a living progeny, from August into winter, without either male or female appearing. Bouché and Kaltenbach in explanation remark that the males in this family are not always winged. However, the May following, Ratzeburg, continuing his observations, found the winged females, and afterwards (in October) winged males also which paired with them. The species was then identified as *A. oblonga*, V. Heyden."

For the male to pair with the winged female is a very unusual case among Aphides, but it very frequently occurs that generations of many families continue viviparous till their final destruction, while other families are privileged to carry on the stock of the species: their circumstances enable both sexes to appear among their descendants, and eggs are consequently laid up in store for the ensuing season. But this subject and others in relation with it will be more fully noticed in another part of these descriptions.

[To be continued.]

XXV.—*On the Ovule of* Euphrasia officinalis. By G. Dickie, M.D., Lecturer on Botany in the University and King's College of Aberdeen*.

In a communication submitted to the Society two years ago, an attempt was made to prove that in certain plants, tubes observed in connexion with ovules are not really in every case derived from the pollen, as stated by some physiologists, but prolongations from some part or other of the ovules. This statement had reference only to a few plants, and the same restriction is still adhered to: it would be rash to generalise in the matter. It was argued in favour of this opinion, that the number and position of the ovules would present obstacles to the pollen-tubes entering their foramina. An argument, it may be said, of greater value was employed, viz. that the development of such a tube might be traced at an early stage projecting from the exostome in the form of a papilla, ending in a blind extremity, afterwards increasing in length and coming in contact with the placenta. The observations of the late Mr. Griffith on *Santalum* were quoted in favour of the idea in question, that acute observer having proved the true nature of the tube sent up to meet the pollen-tube, it being a prolongation of that part which is usually denominated embryo-sac. It was not in my power to speak so emphatically regarding the nature of the tubes in those plants in which they were seen; in *Narthecium, Bartsia* and *Euphrasia* I expressed however my belief that they might be prolongations of the apex of the nucleus. It was considered sufficient at that time to show that prolongations like pollen-tubes might be sent up from the ovule. I have repeatedly examined ovules of *Euphrasia* and have found them uniformly present. I had originally set out with the view of tracing pollen-tubes into the ovule, and if possible observing them in contact with the embryo-sac, and even in the act of causing introflexion of that part. When I say, if possible, the expression has reference to myself; observers of great experience

* Read before the Botanical Society of Edinburgh, 13 Jan. 1848.

and of high authority in points relating to vegetable physiology had made such statements, and implicit confidence was placed in them. Tubes were observed, but for the reasons alluded to I felt convinced that they had origin from the ovule itself.

Additional observations have led me to change the opinion formerly expressed respecting the part of the ovule from which these organs in *Euphrasia* are derived, and the present communication has reference to that point, and to a peculiarity in the structure of the ovule of that plant, which, so far as I am aware, has not been hitherto described.

The substance of the nucleus is very thin about the period of fecundation, the embryo-sac which lines it becoming highly developed. This sac is attenuated at the posterior extremity; its body tapers gradually upwards into a neck, which is bent at an obtuse angle, and near the apex it is bulbous; at this apex or anterior extremity there is the appearance of a fissure or cleft bounded by two or three rounded lobes. In the interior of the neck and bulb of the sac there is distinctly seen a tube which is narrow below, but somewhat dilated at the part corresponding to the bulb of the sac. This tube I have observed in several instances prolonged upwards, passing out at the terminal fissure and ending in a papilla closed at the extremity. I have traced it some way into the interior of the body of the sac, but the presence of the cellular contents has prevented me from being able clearly to see its relation to the very minute embryo, whose outline might be seen shining through. In one preparation in my possession there is an appearance which seems to indicate a connexion between the embryo and the tube, but I cannot decidedly assert that they are continuous. Lying parallel to the embryo-sac, and on the side next the short podosperm, there is another organ similar in structure; it may be compared to a Florence flask in shape; the necks of the two are quite continuous.

The nature of this remarkable appendage was not easily comprehended at first. I am inclined to believe that the arrangement of the parts in *Euphrasia* is somewhat similar to that in some species of *Veronica,* and which has been described and illustrated by M. Planchon, to the accuracy of whose descriptions and delineations I can bear testimony from my own observations. In the earlier stages of the ovule in *Veronica* the upper end of the sac is bulbous, below this it tapers into a neck, then becomes again somewhat dilated at the part in which the embryo afterwards appears, and which may be called the body of the sac; towards the posterior end it gradually becomes narrower and ends in a sharp point. At more advanced stages the neck of the sac presents several varicose appendages. The large appendage already described as lying parallel to the embryo-sac in *Euphrasia,*

and continuous with its neck, is merely a process of that part. In *Euphrasia,* however, the embryo-sac does not appear externally, as in the advanced stages of that of *Veronica.*

The tube already described as traversing the bulb and neck of the sac, and passing some way into the interior of the body of the same organ, is certainly not the least remarkable part of the arrangement. The principal argument against its origin from the pollen has been already alluded to, viz. its closed papilliform end projecting from the fissure in the extremity of the bulb. It is certainly very difficult to pronounce a decision respecting the nature of the extremity of a transparent membranous tube less than a three-thousandth of an inch in diameter. I have come to the conclusion mentioned, after repeated careful examination under various powers of a microscope (by Brunner of Paris) varying from 250 to upwards of 600 diameters. Figure 1 represents a preparation in my possession, in which two tubes are lying beside each other; one of them is evidently broken across, the other is closed at the end; the latter may be traced to the exostome of an ovule, part of which only is represented. The ruptured tube belonged to another ovule which is not represented in the figure. But for the fact just mentioned, I should feel constrained at once to admit, that appearances are much in favour of Schleiden's opinion, excepting that part which has reference to the introflexion of the embryo-sac.

It will now be evident, therefore, that in *Euphrasia,* the ovule tubes are not prolongations of the apex of the nucleus, but proceed from the interior of the embryo-sac. As already mentioned, I am not at present prepared to state positively the relation between the tube and the embryo.

The majority of observers seem to agree respecting the presence of pollen-tubes in the tissue of the stigma and style; and they have been traced into the interior of the ovarium. That part of the subject which has reference to the presence of such tubes connected with the ovule, and their nature, has given rise to much difference of opinion.

Mirbel long ago pointed out the existence of tubular prolongations proceeding from some part of the ovule. Those observed by Mr. Brown in the *Orchideæ* were supposed to have their existence determined by the action of the pollen, but not to be directly derived from it. Schleiden spoke emphatically respecting the pollen-tubes reaching the embryo-sac, and the same was admitted by Meyen, though they differed respecting the subsequent relations of the two. Griffith demonstrated the presence of both pollen- and ovule-tubes. Hartig admitted the existence of three kinds in connexion with the ovules in different plants: first, true pollen-tubes, as in the *Coniferæ*; second, prolongations of the

conducting tissue of the style, as in some *Cruciferæ*; lastly, tubes proceeding from some part of the ovule itself, as in certain *Cupuliferæ*. Gasparrini alludes to their presence in connexion with the ovule, but supposes them to be derived from the conducting tissue of the style; Hartig and he are therefore agreed in this, in regard to some plants at least. In *Orchideæ*, Amici, Mohl and Müller have all recently traced the pollen-tube through the foramina of the coats to the embryo-sac. Hoffmeister has made similar observations in the *Œnothereæ**. Tulasne says he has traced the pollen-tube into the interior of the embryo-sac. The opinions respecting them are therefore three: first, they are true pollen-tubes, an opinion supported by Schleiden, Meyen, Amici, Mohl, Müller, Gelesnow, Tulasne and others; second, they are derived from the conducting tissue of the ovarium, a view supported by Gasparrini, and also by Hartig, in reference at least to certain plants; third, they are derived from some part of the ovule itself, issuing from it, not directed towards it; this opinion derives support from the observations of Griffith and Hartig, and in the first part of this communication I have expressed the same in reference to *Euphrasia*.

Admitting that the pollen-tube reaches the embryo-sac†, the opinions respecting their subsequent relation to each other are the following. The view first promulgated by Schleiden was, that the pollen-tube pushed the summit of the embryo-sac before it and became invested by it. Hoffmeister admits that the tube in some instances where the embryo-sac is very delicate does push it inwards a little distance, but he also speaks of the tube becoming distorted by the resistance of the embryo-sac. Gelesnow, and subsequently Tulasne, state that the tube actually penetrates the embryo-sac and lies within it, and Schleiden has recently admitted the possibility of this in certain cases. Amici, Mohl, Müller and others state that it is merely applied to the sac at or near the apex; Meyen went a step farther, and supposed that their respective membranes were absorbed at the point of contact, thus permitting the direct mixture of the contents of both.

The action of the pollen in regard to the origin and subsequent development of the embryo may next be alluded to. It may however be observed, that the universality of a law having reference to the necessity for the action of the pollen is not now tenable, after the statement of Mr. Smith respecting the female plant of *Cœlebogyne*, and the still more recent observations of Gasparrini on the cultivated Fig. These statements will also di-

* An account of the observations of Amici, Mohl, Müller and Hoffmeister, by Mr. Henfrey, is published in the 'Annals of Nat. Hist.' for Jan. 1848.

† Amici applies the term 'embryonal vesicle' to the earliest stage of this organ.

minish the tendency to call in question the observations on the Hemp long since recorded. Still, the action of the pollen, whatever be its nature, cannot generally be set aside.

It will be necessary to allude briefly to the stages through which the embryo passes. The first or earliest condition is that of a simple cell, the germinal vesicle of Amici and others; it may be compared to the reproductive cells of some of the Algæ, and might be denominated with propriety the *sporoid* stage. The appendage termed 'suspensor' is worthy of notice; it is usually very highly developed in the sporoid embryo, and more so in some plants than in others; in some of the *Cruciferæ*, for example, it attains considerable dimensions. I have seen an embryo of *Draba verna* $\frac{1}{440}$ of an inch long, with a suspensor three times that length. Mr. Griffith describes the embryo in *Gnetum* as being attached to an enormously long, tortuous, but irregularly twisted cellular suspensor, its length varying from $3\frac{1}{2}$ to 5 inches; the whole length of the seed being about 1 inch.

Different opinions are entertained respecting the true nature of this appendage. According to Schleiden's view it is part of the pollen-tube; in the *Orchideæ* it would seem from Amici's observations to be part of the embryo-sac; he states that the part of the sac which was in contact with the pollen-tube becomes elongated upwards, dividing likewise into cells, which are transparent and situated one above another, so as to form a large confervoid filament; thus traversing in the opposite direction the course followed by the pollen-tube, becoming enlarged and passing through the orifices of the tegmen and testa, and being prolonged even as far as the placenta. According to Mohl the suspensor is essentially connected with the embryo, both being produced by the growth and division of the germinal vesicle, the lowest cell, the embryo, growing faster than the others. In *Tropæolum*, however, the development of the suspensor seems to precede that of the embryo; such at least is the result of Mr. Wilson's observations upon that plant*. It has been already stated that the embryo in its first stage may be compared to the spore of an Alga; future observations may afford greater reason than at present for saying, that the sporoid embryo of some phænogamous plants germinates *in situ*, emitting a confervoid filament, and requiring no transference to a new nidus, but finding in the interior of the embryo-sac all the conditions necessary to its existence and future development as a spore up to a certain period. In such Algæ as *Vaucheria*, *Derbesia*, &c., the spores usually escape from the cell in which they are produced; being furnished with cilia they are enabled to disperse themselves abroad, after a time they become fixed, and produce a

* London Journal of Botany, vol. ii. p. 623.

plant like the parent. We may suppose that such change of circumstances is necessary to their proper development; the very fact of number alone would in certain cases be an obstacle to their growth in their original situation. In some instances however they do germinate *in situ*; these form the exception and not the rule. The sporoid embryo is usually solitary (*Citrus, Coniferæ*, &c. present exceptions); it does not require to change its place, but begins to germinate *in situ*, producing a confervoid filament, the embryo suspensor, which is usually directed towards the apex of the nucleus. But it may be objected to this idea, that spores do not germinate from any special fixed point; this however is not proved, for who has yet demonstrated that they have not a fixed point for the origin of the thread they produce? Sometimes however the suspensor is not directed towards the micropyle, but away from it; Gasparrini has observed this in *Citrus*, and Griffith observed that in *Osyris* the part corresponding to the suspensor has a direction quite opposed to the point reached by the pollen-tube. In the ovule of *Euphrasia*, the peculiarities of which have been already described, it is probable that the tubular filamentous appendage which protrudes from the apex of the embryo-sac is a prolongation of the terminal joint of the suspensor; at all events it cannot be derived from the pollen for reasons already given; at the same time it is not denied that the pollen-tube may reach and come in contact with the apex of the sac, though I have hitherto failed in detecting its presence. In a former communication an opinion was expressed that the jointed appendage of the embryo in the *Orchideæ* is no part of the pollen-tube, as supposed by Schleiden, but a process from the embryo itself; it was also added, that a tubular prolongation of its terminal joint might account for the presence of those tubes so abundant upon the placenta, and which had been by most observers considered to be derived from the pollen. From the observations of Mohl and others it would appear that the statement alluded to was only partially correct, their observations having confirmed the first part, but shown the second to be erroneous. For reasons already mentioned it would be premature to state that the production of the confervoid filament or suspensor, in other words, the germination of the sporoid embryo, forms the second stage of its development.

This stage appears to be quite independent of the action of the pollen. Mirbel and Spach in 1839* demonstrated that the first appearance of the embryo, the germinal vesicle, called by them primary utricle, precedes the application of the pollen. This early formation of the germinal vesicle, the first outline of the embryo, was proved by them in a large number of

* Report by M. Giraud in 'Annals of Nat. Hist.' vol. v.

Gramineæ. Its independence of the pollen need scarcely be spoken of in *Cœlebogyne* and *Citrus* already alluded to. The observations of Mohl on the *Orchideæ* lead to the same conclusion; those of Müller on the same family have a similar import. Mr. Henfrey in his report already quoted observes, "The whole question appears to be narrowed to the determination of the point, whether the germinal vesicle does actually exist before impregnation, since if that can be proved, all appearances yet observed may be reconciled by allowing for very slight errors in interpreting and delineating them."

The most careful and trustworthy observers speak with caution respecting the real nature of the action produced by the pollen-tube upon the ovule in impregnation. We have seen that at least one stage of embryo-life is independent of the contact of the pollen-tube with the embryo-sac; this I have ventured to denominate the sporoid stage. In some few cases, viz. *Cœlebogyne* and others, all the stages are equally so; generally however the future progress of the embryo is determined by the action of the pollen, whatever the nature of that action may be. The production of true radicle, cotyledons and plumule will constitute the last stage of embryo-development, and it is in reference to it that the best instruments cease to afford us any precise information. We can trace the progress of the organs in question, but we cannot state precisely in what way the action of the pollen influences their development. We do not derive any very clear information from such statements as those of Oken*, when he tells us that "the pollen electrifies, animates or inspirits the ovarium—that the male imparts nothing in impregnation but the solar ray or fluid nervous mass in its semen, which awakes, animates and inspirits the quiescent female—that the pollen is a most highly differenced electrical product; the seed-granule a wholly indifferent and tranquil mucous mass. The pollen falls upon the stigma of the pistil, and irradiation has taken place; the material fruit-capsule gains thereby so much polarity, that saps enough ascend, in order to develope the germless seed-vesicles."

The theory of Schleiden had the advantage over all others that it directly accounted for the presence of the embryo. Some observations of Mr. Griffith seemed to lead to a conclusion nearly similar, the difference being that the embryo is not developed directly from the end of the pollen-tube, but from cells produced by that part. It is presumed that no one has hitherto traced a tube through its whole length, connected with the pollen-grain at one end and with the embryo at the other.

* Oken's Philosophy of Nature, Ray Society, 1847.

Fig. 1. Part of an ovule with a tube issuing from the foramen and terminating in a closed extremity.
Fig. 2. Embryo-sac and appendage.
Fig. 3. Part of another more highly magnified, showing the tube which traverses the sac.
Fig. 4. Neck and bulb of the sac with tube more highly magnified.

XXVI.—*On the Insects of Jamaica.* By Philip Henry Gosse.

[Continued from p. 202.]

39. *Calopteron bicolor.* On the trees at the forest-edge, on each side of the Hampstead Road, this *Lycus* was excessively abundant in June 1845 and 1846, particularly in the latter year. Hundreds, I should judge, were sometimes on a single small tree. They rested principally on horizontal branches from the height of ten feet upwards.

40. *Pygolampis xanthophotis** (mihi).

41. *Photuris versicolor.*

42 to 53. Twelve other species of *Lampyridæ*, all luminous.

The fire-flies of the tropics have been often described. The *Lampyridæ* are, in Jamaica, far more abundant than *Pyrophorus noctilucus.* At all times, their sparks, of various degrees of intensity, according to the size of the species, are to be seen, fitfully gleaming by scores about the margins of woods, and in open and cultivated places. *Photuris versicolor*, a large species with drab-coloured elytra, I found abroad soon after my arrival, in December. One flying around the house, in the evening, I was struck with its swift and headlong flight and nearly permanent luminosity, which was much more brilliant than that of any species which I had at that time seen.

The large *Pygolampis*, to which, for precision's sake (as I have a note concerning it), I have given a name, I did not meet with until May, when one flew into the house at Bluefields in the evening; and two nights afterwards I observed it rather numerous on the very sea-beach at Sabito. It was conspicuous for the intensity of its light, much exceeding that of *Photuris versicolor*. Sometimes it is only the last segment but two that shows luminosity, but when excited the whole hinder part of the abdomen is lighted up with a dazzling glare.

It is in the woods of St. Elizabeth's, in the month of June, that I have seen the *Lampyridæ* in their glory; and particularly along the road leading up the mountain from Shrewsbury to Content, where it is cut through the tall forest, which overhangs it on each side, making it sombre even by day, and casting an impenetrable gloom over the scene by night. The darkness here, however, and especially at one point, a little dell, which is most obscure, is studded thick with fire-flies of various species, among

* This fine species may be thus described. Length 9 lines; breadth $3\frac{3}{4}$ lines. Elytra smoke-black; thorax drab, the central portion dark brown; abdomen pale, the last three or four segments cream-white. Specimens in Brit. Mus.

which the two large ones above-named are conspicuous. I have delighted to watch and study their habits in this lonely spot, while the strange sounds, snorings, screeches, and ringings, of nocturnal reptiles and insects, sounds unheard by day, were coming up from every part of the deep forest around, giving an almost unearthly character to the scene.

Pygolampis xanthophotis is seen only in flight: its light is of a rich orange-colour when seen abroad, but when viewed in the light of a candle appears yellow. It is not of so deep a tint as the abdominal light of *Pyrophorus noctilucus*. It is intermittent.

Photuris versicolor is noticeable by its frequent resting on a twig or leaf in the woods, when it will gradually increase the intensity of its light till it glows like a torch; then it gradually fades to a spark, and becomes quite extinct: it thus remains unseen for some time, but in about a minute, or, it may be, two, it will begin to appear, and gradually increase to its former blaze; then fade again; strongly reminding the beholder of a revolving light at sea. The light of this species is of a brilliant green hue. I have seen a passing *Pyg. xanthophotis,* attracted by the glow of a stationary *Phot. versicolor,* fly up and play around it; when the intermingling of the green and orange rays had the same charming appearance as the two lights of *Pyrophorus noctilucus* noticed in the preceding part of this memoir.

The smaller species have, some yellow, some green light: I have noticed only these two colours in the luminosity of such *Lampyridæ* as I have observed.

Pygolampis xanthophotis, when held in the fingers, will frequently illuminate the antepenultimate segment of the abdomen, over which the light plays fitfully, sometimes momentarily clouded, more or less, but generally saturated, as it were, with most brilliant effulgence. This species occasionally comes in at open windows at night, but much more rarely than *Photuris versicolor* and the smaller kinds, a dozen or more of which may be seen almost every night, especially at Content, crawling up the walls or flitting around the room and beneath the ceiling.

At Content, in the latter part of July, I found in fresh-turned earth a larva of a *Lampyris,* small and lengthened: the abdomen was furnished with a retractile brush of divergent filaments, ordinarily concealed; but having no lens with me I could not examine it particularly.

54. *Nitidula* (sp. nov.). Found with a *Philonthus,* rather numerous, in the centre of decaying rose-apples (*Eugenia jambos*) on the Hampstead Road in June.

55. *Dermestes lardarius.* Probably introduced. Sadly abundant in the skins of my preserved birds, at all times.

56. *Helops* (sp. near *celestinus*). A single specimen found on

the ground, on Grand Vale Mountain, St. Elizabeth's, early in June.

57. *Diaperis*? (sp. nov.). Found at New Forest, near Alligator Pond, where the singular honey-combed limestone is the common rock. It was in December.

58. *Rhipiphorus* (sp. nov.). A single specimen taken in June, on the Hampstead Road: it was resting between two leaves of a shrub.

59. *Mordella* (sp.).

60. *Tenebrio* (sp.). Common under heaps of stones in Bluefields pasture.

61. *Upis* (sp. nov.).

62. *Attelabus* (sp. nov. very near *aureolus*, Klug). This pretty little insect was very numerous in June on the Hampstead Road, and it occurred also at the same season on Bluefields Mountain. We invariably found the specimens resting on the leaves of trees that overhung the road, and for the most part about ten or fifteen feet from the ground. They were apt to fall off on the slightest alarm. It has an odd appearance, as if it were but two-legged, from the great development of the anterior pair of legs. The spot on each elytron is golden during life, but after death fades to a dull drab hue.

[To be continued.]

XXVII.—*On the Habits and Geographical Distribution of* Bulimus, *a genus of Air-breathing Mollusks.* By Lovell Reeve, F.L.S.

The beautiful forms and varieties of shells produced by those air-breathing mollusks, which, under the generic appellation of *Bulimus*, constitute an important division of the great tribe of Snails, have become objects of especial interest to the conchologist, owing to the zeal with which a few enterprising scientific travellers have lately penetrated into tropical countries in pursuit of them. It is, however, to the productive exertions of Mr. Cuming that we are mainly indebted for the newer and more attractive species. The researches of this ardent naturalist in the arid plains on the west side of the Andes, in the dense woods of West Columbia and Central America, and more recently in the luxuriant open forests of the Philippine Islands, whilst they present an instructive contrast, exceed any result the most sanguine collector could have anticipated. In the dry and barren regions of Western Chili and Peru, the *Bulimi* are mostly small, and of comparatively fragile structure; but in the beautiful islands of the Eastern Archipelago, where climate and vegetation com-

bine to favour the growth of arboreal species, the genus is represented with prolific splendour. Mr. Cuming must have truly felt like one transported to the fabled garden of the Hesperides, when beholding the lofty trees of these sunny isles laden with snails of such magnificent proportions. Aladdin, in the Arabian tale, could not surely have contemplated the rich clusters of varicoloured fruit in the garden of the African Magician with more astonishment, nor probably gathered it with more avidity.

"It was in 1836," relates Mr. Broderip, "that Mr. Cuming proceeded to the Philippine Islands by permission of the Queen Regent of Spain, and aided by powerful recommendations from her government, which opened to him the interior of the islands, and caused him to be received with a noble hospitality, equalled only by the warm interest which facilitated his pursuits wherever he arrived and made himself known." Species of which we had but an imperfect knowledge, in consequence of the bad condition in which a stray individual chanced to reach our cabinets, were found in luxuriant plenty, and many new kinds were discovered in their airy solitude in equal abundance. Had De Férussac, the enthusiastic admirer of this tribe, lived to see the glorious series of *Bulimi* accumulated in the Cumingian collection in different stages of growth, and in the finest state of preservation, from the egg to the adult, he would have been indeed amazed.

The genus *Bulimus*, as restricted by Lamarck, comprehends an extremely natural group, though presenting important differences of growth and texture; and these variations are peculiarly local. In the Philippine Islands, the species are of large and rather solid growth, with a remarkable hydrophanous epidermis, that is, permeable by water or other evaporable fluid; on the barren hills of Lima, and in the sandy plains of Chili and Peru, they are mostly small and delicately formed; in Brazil, the species are remarkable for having the aperture in frequent instances denticulated; and in New Caledonia, Venezuela, New Granada and New Hebrides, they not uncommonly exhibit with equal peculiarity a plaited *Auricula*-like columella.

It is a curious feature in the Philippine species, that the varieties of pattern which constitute their chief ornament reside only in the epidermis. The colours of the shell rarely describe any sort of configuration; they are mostly blended into a uniform tint, over which a fanciful pattern is produced by the epidermis forming a double porous membrane in some places, and a single one only in others, developed, moreover, with the same continuous regularity as the textile marking of a Volute or Cone. This phænomenon is easily detected by immersing the shell in water, when the light portion, or upper porous layer, of the epidermis becomes saturated, and the ground colour of the shell is seen

through it; as the moisture evaporates, the epidermis resumes its light appearance. Sir David Brewster, in reply to a letter from Mr. Broderip on this subject, says: "It appears to me, from very careful observations, that the epidermis consists of two layers, and that it is only the upper layer which is porous, wherever the pattern is white. These white or porous portions of the epidermis differ from the other parts of the upper layer only in having been deprived of, or in never having possessed, the element which gives transparency to the membrane; in the same manner as hydrophanous opal has become white, from the expulsion of its water of crystallization."

There is little variety in the animal of *Bulimus*: the Chilian species are mostly of a light colour, and a few in this and the Columbian district are spotted, some having a transparent shell through which the spots are visible. The Philippine species are, without exception, of a sombre olivaceous brown, and dwell in family groups, as it were, among the shady foliage of the branches. Out of a group of some dozen living specimens, not more than three or four may be found in an adult state with the lip of the shell reflected. They may be dislodged by shaking the branches, but are chiefly disturbed by the heavy rains with which these islands are at times visited. Mr. Cuming preferred, however, to collect them in dry sunny weather, because he was sure of finding the objects of his search in their shady places of retreat. In the immense sandy tract on the west side of the Andes, the reverse of this condition of nature prevails. The *Bulimi* are here physically very distinct; some reside all the year round upon the numerous *Cacti*, but during the dry season, which lasts for several months, they live mostly in a state of torpor, inclosed within their shell by an epiphragm, and buried in the sand or under stones. On the approach of the dews they revive to a state of animation, and crawl about at night in quest of food.

In illustration of the remarkable drought that prevails in Northern Chili, and of its effect upon molluscous life, I am tempted to repeat, in brief, an anecdote related to me by Mr. Cuming. On the arrival of our friend at the port of Copiapo in 1829, he discovered the beautiful *Bulimus Broderipii* in considerable numbers, in the fissures of the rocks that may be seen here and there in the sandy plains of that country. Finding a large proportion of them dead, with the soft parts entirely decomposed, he requested a solitary inhabitant of the place to collect as many specimens as he could pick out alive, whilst he occupied himself in botanizing. Returning from his excursion, Mr. Cuming was greatly disappointed to find that among the quantity his Chilian collector had accumulated, there was scarcely one in a living state. Upon remonstrating with him for his inattention, the native re-

plied: "Only wait till the dews come, and they will be all alive again." Mr. Cuming rejoined: "I suppose you mean when it rains." The man, however, in perfect astonishment inquired what he meant; though a sexagenarian, he had never heard of such a thing as rain.

The *Bulimi* vary in their mode of propagation: fragile species with the lip of the shell simple are mostly viviparous, while those with a reflected lip are oviparous. The arboreal species of the Philippines deposit their eggs in little clusters on the trees, between two leaves which the animal manages to curl up, one upon the other, so as to form a receptacle for their protection; and so far as Mr. Cuming's observations go, they are all soft, like snakes' eggs, with the single exception of the *B. Mindoroensis,* in which instance the eggs are calcareous, deposited upon a leaf in parallel rows, each standing perpendicularly on end, attached at the base by a glutinous substance.

The habits of the *Bulimi* in the two widely-remote countries explored by Mr. Cuming having been treated of in the foregoing remarks, it only remains to speak of them in other parts. Turning to New Holland, we are unexpectedly surprised to find that the genus is there represented to an extremely limited extent. I am not aware of more than three species having been found in this wide expanse of country, although several fine *Helices* have been discovered; and in a region of which the Fauna and Flora exhibit so luxuriant and distinctive a character, the scarcity of a genus of so much importance in the Eastern Isles is remarkable. The same observation applies to New Zealand, from whence, so far as the interior of the islands of that group has been visited, no more than one or two species have been received. In Africa, the *Bulimi* are almost as great strangers as in the localities just spoken of; throughout the whole extent of land yet explored of this vast continent, scarcely a dozen species have been obtained. The *Bulimi* are here replaced by *Achatinæ.* Such a phænomenon may also be observed in some of the islands of the Pacific; in the Sandwich Islands the *Bulimi* are replaced by the genus *Achatinella,* and in the Society Islands their place is occupied by the *Partulæ.* In the West Indies the genera *Achatina* and *Glandina* seem to prevail. Howsoever abundant is the genus *Bulimus* in most of the islands of the Eastern Archipelago, few species appear to inhabit the great territories of India and China. On the coast of Borneo a beautiful one was recently discovered by Mr. Adams of H.M.S. Samarang by the accidental falling of a tree in a woody islet situated between Banguey and Balambangan; but they are of rare occurrence in that locality. In Europe, where nature is exposed to the vicissitudes of a colder climate, the *Bulimi* are mostly small, and exhibit no brilliancy of colour; so

also in the extensive district of North America, where no more than a few insignificant species are known to exist. It is in the richly fertile and woody district of Columbia that the genus *Bulimus* is represented with a magnificence little inferior to that of the Philippine Islands: here they are large enough and sufficiently abundant to be roasted and eaten by the aborigines, as a frequent article of food. Several fine species, entirely new to science, have been collected in Venezuela and New Granada by Mr. Linden, an assiduous botanical traveller, only within the last twelvemonth, at an altitude of 5000 to 8000 feet, and many more, no doubt, dwell in undisturbed solitude in the vast interior of that immense continent. It is extremely probable that a large portion of South America yet remains to be explored by the adventurous naturalist, inclosing a fine expanse of forest country, grand in extent, rich in foliage, and possessing all the elements favourable to the growth and beauty of arboreal mollusks.

XXVIII.—*Reports on the Progress of Physiological Botany.* No. 3. By Arthur Henfrey, F.L.S. &c.

On the Growth of Leaves.

In that remarkable book, Hales's 'Vegetable Staticks,' we find the account of an experiment made to determine the mode of growth and expansion of leaves. The method Hales adopted was to *tattoo*, as it may be called, young leaves with punctures made by means of a little instrument on which pins were fixed at determinate distances in parallel rows. In the fig-leaves on which he experimented he found that the punctures were separated from one another during the growth, but maintained their relative distances unaltered, and from this he concluded that "the growth and expansion were owing to the dilatation of the vesicles in every part." In his figures, however, it may be noticed that the leaf has grown more at the *borders and apex* than within the punctures.

Similar experiments have recently been made by M. Gaudichaud*, and he makes the following meagre statements in regard to the petioles and leaves. (The marks were made on young plants of the horse-chestnut raised from seed.) The marks made on the petioles increased their distance two or three times the diameters, equal or unequal, of the original measures, and the proportions of the upper parts generally exceeded those of the lower. It might be imagined that the blades of the leaves would be

* Comptes Rendus, May 10th, 1847.

subject to the same law of growth, but they present more anomalies than any other parts. He states that these are however more apparent than real, and promises to give a detailed account at some future time.

The generally received opinion with regard to the growth of leaves is that, in contrast to the stem, they grow at their base only, and their summits are therefore considered to be the oldest parts.

Link* however states that the leaf appears at once in the bud with all its parts formed, and that it then grows by interstitial development, but mentions one exception, in the Walnut, where the leaves appear ternate or tripartite at first, and the other lobes appear subsequently. Schleiden† declares that the apex is the oldest part and the base the youngest, and that although the process of development within the leaf may increase its size and influence its internal structure, it has no power of determining its form; while to complicate the subject still more, Nägeli ‡ has just published a paper advocating the diametrically opposite opinion. His views are so definitely expressed that they well merit an examination.

In the first place he draws a marked distinction between two modes of growth which necessarily exist in all leaves, viz. 1. *growth* by *cell-formation*, and 2. *growth by the expansion of the cells*. Considering the fronds of the Algæ to represent leaves, he first points out how these grow by their apices and borders, the increase in length resulting from the continual division of the *apical cell* (*scheitel-zelle*), and the increase in breadth, where the lobe or branch consists of several parallel rows, by the development of the outer marginal cells. The same occurs in the *Characeæ*. In the *Hepaticæ*, if the leaf consists of a branched series of cells (as in *J. tricophylla* and *J. setacea*), it grows by the apical cells as in the *Florideæ*. If the leaf is a layer of cells—in the Mosses it possesses *one* continually developing apical cell and the lateral growth is simultaneously effected by the division of the cells left behind as it were by the apical cell, which divide by a septum at right angles to that of the primary cell, and the first two producing four, the outer one of each pair repeats the process, and so on till the whole growth in width is completed. In the *Hepaticæ* when the leaves are layers or plates of cellular tissue like those of the Mosses just described, the process is similar, except that they appear generally to have several *apical* or *primary* cells. When the leaves are more than one layer thick, as is often the case in the midnerve, septa are found in the cen-

* Elem. Philosophiæ Botan. i. 438.

† Grundz. der Wiss. Botanik, 2nd edit. vol. ii. p. 172.

‡ Schl. and Nägeli's Zeitschr. für Wiss. Bot. part 3, 153.

tral cells parallel with the surface of the leaf, and the process extends outward from the central to the lateral cells according to the specific peculiarity of the plant, but it is always the *central* cell which first divides.

In the *Lycopodiaceæ* and *Equisetaceæ* the leaves also grow in length and breadth by the development of their apical and marginal cells. The Phanerogamia follow the same law. In an imperfect leaf, the cells at the border and apex are full of the homogeneous mucilage (protoplasm), while in the others it is already transformed into yellowish or greenish granular matter. Sometimes the formation of the septa may be observed in the marginal cells. In thin leaves the increase in length by the division of the *apical* cell may frequently be observed during the growth of the plant.

The fact that the leaves of Phanerogamia grow at the apex and borders and not by the base, is most easily seen in compound or much-divided leaves. As a general rule the lateral axes shoot out from the main axis in succession from below upwards; in like manner grow the tertiary axes (when present) from the secondary.

In *Astragalus* (which is figured by the author) it is shown that the uppermost leaflets are the youngest, the lowest the oldest and largest.

In *Utricularia* the growth of the leaf originally and of the divisions subsequently, may be seen to occur by continual development at the apices of the main axis and the divisions. In *Myriophyllum* however was found an exception, the upper lobes of the leaf being formed first.

The thickness of the leaf, the various inferior layers of the epidermis and the parenchyma depend on another mode of growth, which Nägeli calls, in opposition to the *peripherical cell-development, cell-development in every direction* (*allseitige Wachsthum*). Three forms of this occur: 1. It is either absent or merely follows at a little distance the development of the apical cell from below upward and soon ceases. In this form the development of the cells often ceases in the lower part of the leaf before it is complete at the borders. *Utricularia* is an example. 2. The development in every direction occurs simultaneously in all parts of the leaf, which completes its peripherical growth very rapidly. The growth in this form usually ceases in all parts about the same time. 3. The development in every direction begins, after the rapid completion of the peripherical growth, either only or at all events principally on the upper part of the leaf and extends downward. It ceases at the base last.

There is also sometimes an *abnormal growth in every direction*, which occurs either in particular cells or in the whole tissue, and does not appear to be subject to any laws.

The *growth of leaves by the expansion of the cells* is subject to various modifications.

In the Algæ the expansion does not usually begin until the growth by development is complete. It then commences in the uppermost cell and extends gradually to the base. In those branched filaments where the cells break up (*Polysiphonia*, &c.) the uppermost cell falls off first, and the process extends downward to the others in succession. There are some few exceptions to this rule, where the expansion of the cells is simultaneous, or even begins in certain other parts instead of the apex. Those Algæ however which consist of single branched cells must of course be excepted from the rule, as the expansion is the extension of one individual cell, and that proceeds from below upward.

In the Mosses and *Hepaticæ* the expansion commences, after the completion of development, at the apex and extends gradually downwards. In *Characeæ* the terminal cells expand first. In the *Lycopodiaceæ* the expansion also proceeds from the apex to the base.

In the Phanerogamia as a general rule both in simple and compound leaves, the expansion commences at the summit, but this rule is not without exception. In some leaves the expansion is tolerably simultaneous, while in others, as in *Utricularia*, it extends like the development from below upward. There does not appear to be any rule for the expansion of the petiole of compound leaves.

Drawing the conclusion as to the origin of the leaf in the higher classes from analogy, Nägeli propounds the following formulæ as the expression of his views:—

1. *The leaf originates as a simple cell.*

2. *The growth by cell-formation occurs at the apex and on the border, and proceeds, from the base, upwards and outwards.*

3. *The growth by the expansion of the cells begins, on the contrary, at the apex and extends to the base.*

Now these formulæ look remarkably definite and clear, and if we could receive them, our knowledge of these structures would be much simplified; but unfortunately, although the laws of development are simple, fundamentally, they are subject to innumerable modifications in their application, and I cannot think that Nägeli has taken all the conditions of leaves into consideration, and I believe therefore that he has generalized much too freely.

In the first place it is a question whether the fronds of the Algæ are always the analogues of leaves: if we have leaves in them, we also have leaves and stems, and probably often stems

alone; and although he is in accordance with most authors in stating that the fronds of Algæ grow by their apices and borders, there are also exceptions here—for instance in *Laminaria digitata*, where the new frond is produced by the expansion and development of the stalk-like part of the old one. Passing by these, it is evident that the leaves of Mosses and *Hepaticæ* differ widely from those of the Phanerogamia in general in their development, though they bear considerable resemblance to such as those of *Utricularia*, &c., and many of the Monocotyledons.

The leaf of a Dicotyledon originates as a little papilla of cellular tissue: if it is a lobed leaf, these lobes appear in succession; thus at first we see a little cone, then a three-lobed flattened papilla, next a five-lobed, and so on; and here it is difficult to say how we shall prove, how in the five-lobed form the intermediate lobes originated—whether they are new ones, or the two original lateral lobes pushed up by two succeeding lobes—since we can only make observations on separate leaves, not *see* them grow; but as it is clear that the papilla does grow at the base, becoming narrowed into a petiole and pushing the whole of the blade up, we have a right to assume that the leaf does in the first instance develope at its base. But then we must not generalize for the whole growth from this, since as soon as the petiole is distinctly formed, the petiole and the lamina have distinct growth; and now the leaf in its expansion by the multiplication of its cells must grow chiefly at its borders, since the centre of the base, that is, the point of junction with the petiole, must retain its relative position, and may therefore be considered as the point of departure of all growth in the lamina; so that as the apex and the borders are subsequently at a greater distance than at first, they must develope away from it in all directions, whether by mere marginal and apical alone or by central development also, since in the latter case the border must grow to make room for the growth in the centre. Nägeli says that the growth by expansion of the individual cells commences at the apex, but it would very often be difficult to distinguish whether this expansion at the apex depends on development of cells or actual expansion of those already formed; he probably reasoned from analogy here in regard to the Phanerogamia. Most experiments have shown the expansion to be tolerably simultaneous throughout.

The leaves of Monocotyledons, such as those of the common bulbous plants at least, appear to develope chiefly, if not solely, at the base. In those which have petioles there must be a difference, but in such we observe the growth or actual development to continue longer in the petiole than in the blade.

The forms of leaves differing so much even in the same species, often in consequence of difference in the amount of paren-

chyma, it appears to me that the laws of growth of leaves must be looked for in the course of the development of their framework, the nerves. These are apparently organized gradually out from the stem into the nascent leaves, just as the vascular bundles into the apex of the stem, and their point of separation in the blade being fixed from the first, it is clear that all growth in the blade of the leaf must occur beyond this, and it is most natural to suppose that the nerves become organized from this centre outward as the vascular bundles were from the stem at first. Thus it would happen that Dicotyledonous leaves in general would grow at their base until they were sketched out as it were, in the bud, but as soon as the nerves were formed and the plan of the framework of the future expanded lamina laid down, the growth would be apical, marginal and interstitial. In Monocotyledonous leaves with straight veins there appears to be nothing to prevent the continued development of the base, and as we usually find the tissue in a softer and less consolidated condition there, it is probable that that part is the seat of development. These ideas are merely suggested as rational interpretations of the facts before us, but much systematic observation is required before this question can be settled.

XXIX.—*On the* Ventriculidæ *of the Chalk; their classification.* By J. Toulmin Smith, Esq.

[Continued from p. 220.]

Genus Cephalites.

Character. Pouch-shaped: very constant in size and dilatation: cavity usually regular and with a single opening; sometimes winding and with more openings than one: membrane forming the wall of the cavity always deeply folded: marginal edges—and, sometimes, most prominent points—of the plaits attached to a simple apolypiferous membrane stretched across their whole breadth and forming the upper margin or head of the wall: membrane of wall polypiferous on both external and internal surfaces.

The differences between the genera *Cephalites* and *Ventriculites* are so broadly marked that, except in one or two species, it would be difficult to confound even fragments of the two. In every species of *Cephalites* the head is conspicuous and unmistakeable. This very remarkable peculiarity is alone sufficient to distinguish the genus*.

* See ante, p. 46.

The provisions found through the whole family of Ventriculidæ for ensuring the free access of sea-water to all parts of the surface, and for securing permanence of form as one great means to that end, have been already noticed*. The present genus offers fresh and most remarkable illustrations of those provisions.

In every species of this genus the fold is, comparatively to the size of the whole body, much deeper and broader—in many species positively much deeper and broader—than in any species of the genus *Ventriculites*. The size also is much smaller than the average size of the *Ventriculites*; the height of specimens of the present genus seldom exceeding two inches, rarely attaining three inches†. The form is never expanded, as usual in *Ventriculites*, but, with few exceptions, approaches nearly to the cylindrical, as in *V. tenuiplicatus*.

Extent of surface was thus gained in this genus by the increased depth and complexity of the fold. But this depth and complexity would endanger the safety of the polypiferous surface were there no special provision for maintaining the normal position of the individual plaits. This was perfectly effected, and at the same time with great simplicity and beauty, by stretching across the flat upper edges, or, in a few cases, the more prominent points‡, of the plaits a simple and entire membrane§, which, spread over the whole breadth of those edges and from point to point of those prominences, retained all the plaits securely in their position; thus ensuring the safety of the whole colony and of the entire polypidom which was covered by it. See Pl. XIV.

The general constancy in the size and form of specimens of this genus throws difficulties in the way of the question of growth. It is not easy to understand why we do not find young individuals of this genus as of *Ventriculites*. It has occurred to me

* Ante, pp. 41, 203. It was the circumstance of the Ventriculidæ being polypiferous on *both surfaces* that rendered these provisions so necessary. In *Halodactylus*, &c. one surface only is polypiferous. See note ‡ p. 41.

† Hence all the figures of this genus are of specimens of average size. I have much pleasure in acknowledging here the pains and care bestowed by Mr. Sowerby over these plates. The novelty of the forms and structure presented many difficulties, especially as the engravings were made only from my drawings. But nothing can be more generally successful or truthful than the figures which Mr. Sowerby has realised.

‡ These latter cases form, however, no exception to the principle of the marginal edge of the plaits being always attached to the cephalic membrane. The cases in which prominent points of the plaits are attached to the head are cases of an *additional* provision for security. In those cases, as in all others, the marginal edge of the membrane, after having undergone all its varied modifications of fold, reaches and is attached to the head. See the description of *C. campanulatus* and *C. constrictus*.

§ As to structure and nature of this see ante (vol. xx.) pp. 96, 188.

that, probably, the ocean in which this genus dwelt being, apparently, a more disturbed one than that in which the *Ventriculites* dwelt*, and the head possibly not forming till a certain age and size had been attained, individuals dead or destroyed below that age very rapidly lost their form and are therefore found only as shapeless masses. I do not suggest this solution of the difficulty, however, without considerable hesitation.

The whole genus *Cephalites* is characteristic of the Middle Chalk. I have never found a single specimen which I could with any probability refer to the Upper Chalk, though it may be expected that some forms will be found which endured into that later epoch. Certainly none have been ever yet found in the Lower Chalk.

§ *a. Annulati* †.

Head narrow and flat: plaits compact and regular.

1. *Cephalites longitudinalis.* Pl. VII. (vol. xx.) fig. 1, & Pl. XIV. fig. 1.

Plaits delicate but often deep: outer plaits slightly winding: inner plaits depressed at short and regular intervals; bulging on each side around depressions till the adjoining plaits meet and open into each other: processes very conspicuous: wall moderately thick.

This species much resembles in external aspect the smaller cylindrical specimens of *Ventriculites tenuiplicatus*. It is however smaller than that species usually is, the plaits less winding, and the wall thicker. The depressions on the inside also are generally smaller, closer, and more regular than in that species. The head alone is sufficient to distinguish the two at a glance.

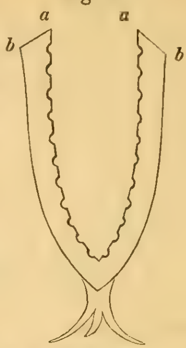
This is the only species of *Cephalites* in which the longitudinal fold remains unmodified on the outer face. Hence its specific name. A transverse section of it is seen on fig. 1 of Pl. VII.

It is a rare and delicate species: indeed all the species of the present genus are rare. They do not seem to have abounded in the older seas of the Middle Chalk as the *Ventriculites* did in the Upper Chalk. Though thus rare, however, their modifications are not the less clearly marked.

In regard to the head it is proper to remark, that while, throughout the present division of this genus, its breadth will always be found a very near approximation to that of a transverse section of the plaits, there is a slight variation in this respect in individual specimens. The head often slopes a little outwards, so

* See ante, p. 204.

† See ante, p. 47.



that a section of the entire body presents an outline as in fig. F, in which *a*—*b* is the section of the head. The outline of the head is always quite as sharp and well-defined as in this figure. The relative arrangement and proportions of the head and the plaits are such that specimens of this division can never be confounded with any belonging to the section *Dilatati*. It is very rarely in the present division that there is any rounding, or departure from the nearly flat character of the head; a character, on the other hand, never present in the *Dilatati*.

It is proper to notice that, in every species of this genus, in order to give full strength to the head, the depressions, bulgings, and other modifications of the fold,—where it does not rise, as in *C. campanulatus*, in a simple form,—are so arranged that the membrane of the inner wall, where it adjoins the head, is always, and that of the outer wall most frequently, expanded by a lateral bulging of the plait, so as for the adjoining plaits to meet just at the point of union of the wall with the head. Thus the whole of the inner, and often of the outer, edge of the head is *continuously* attached to the wall, an arrangement of much importance. On this inner edge the membrane often rises up in a narrow and slightly prominent ridge above the otherwise smooth surface of the head.

2. *Cephalites guttatus*. Pl. XIV. fig. 2.

Plaits broad and deep: outer plaits raised in large hollow bosses, often elongated; adjoining plaits having an occasional lateral connection: inner plaits depressed at regular intervals, bulging on each side around depressions till adjoining plaits meet and open into each other: processes very conspicuous: wall usually thick.

Nothing can better express the usual character of this species than the term *guttatus*. The outer surface looks exactly as if sprinkled with drops of a viscid fluid which had just begun to run together, in some instances to a greater, in others to a less extent. It is thus generally well distinguishable, even on the outside, from *Ventriculites mammillaris*. The plaits being much broader than in *C. longitudinalis*, the depressions on the inner plaits are larger than in that species.

The lateral connection between adjoining external plaits, as in *Ventriculites latiplicatus* and *radiatus*, which is only rarely seen in *C. longitudinalis*, is always more or less present in this species,

and furnishes another characteristic by which it may be at once known from *V. mammillaris*.

3. *Cephalites paradoxus*. Pl. XIV. fig. 3.

Plaits narrow but deep: outer plaits depressed irregularly; bulging around depressions till the adjoining plaits meet and open into each other: inner plaits regular and simple: processes conspicuous: wall thick.

I have given to this remarkable species the name *paradoxus*, because it differs from every other species of this genus in having the plaits simple and regular on the inside, while all the complexity is on the outside.

The depressions, and consequently the interspaces between the anastomosing bulgings on the outside, are not of a regular figure, as is the case on the inner surfaces of *Ventriculites radiatus* and other species. They are varying and elongated; often almost angular; though, as the plaits are narrow, never very large. There do not appear to be any points of anastomosis* between the adjoining inner and regular plaits, such as are found between the outer plaits of *V. radiatus*.

4. *Cephalites alternans*. Pl. VII. (vol. xx.) fig. 2, & Pl. XIV. figs. 4 & 5.

Plaits rather broad and very deep: both outer and inner plaits depressed at unequal intervals; bulging on each side around depressions till the adjoining plaits meet and open into each other: processes conspicuous: wall thick.

The mode of fold in this species resembles that of *Ventriculites bicomplicatus* in the fact of being repeated on the plaits of each surface. It differs essentially, however, in the fact that the depressions, though generally round, are, on neither surface, at regular intervals: consequently no regular figure is assumed in the general aspect of either surface.

I have named the species *alternans* from the circumstance of the repetition on the two surfaces of the same manner of fold; while the straight plait is clearly traceable in the central portion of the wall. A transverse section of a specimen of this species is seen on Pl. VII. fig. 2. Its difference from a similar section of *C. longitudinalis* is very marked.

This is an extremely rare species.

* The appearances seen on dissecting away the inner surface must not be mistaken for this anastomosis. They are, in fact, the bases of the depressions on the outer plaits. See the description of a similar appearance on the outside of *V. tenuiplicatus*, p. 217.

5. *Cephalites bullatus.* Pl. VII. (vol. xx.) fig. 3, & Pl. XIV. figs. 6 & 7.

Plaits broad and deep: outer plaits raised in large and very prominent projections at considerable intervals, and in such manner that they range spirally round the whole body: projections nearly lozenge-shaped and terminating abruptly in an almost flat and somewhat expanded top, having a slight depression from the upper angle towards the middle: inner plaits having large circular depressions at equal intervals; bulging on each side around depressions till adjoining plaits meet and open into each other: processes very conspicuous: wall very thick.

This is a most curious and interesting as well as rare but well-marked species. The depressions on the inner folds are much larger than in *C. guttatus,* which latter have been seen to be larger than in *C. longitudinalis.* But the external fold is the most deserving of attention. When the specimen is first opened there are seen only a number of nearly semilunar marks. On carefully applying the point of the knife it is found that this semilunar appearance is caused by very prominent projections, the tops of which are all closed, but have a partial depression at their upper extremity, and which depression is filled as usual with the matrix. The projections themselves are of large size, measuring about two lines in their longest diameter. They stand out nearly or quite half the thickness of the wall, which is generally four lines thick (see fig. 3. Pl. VII.*). They differ widely from anything we have yet seen. Instead, like *Ventriculites mammillaris,* of being mere rounded elevations on the plait, they stand out prominently from it; and a careful dissection shows that their shape is generally that of a lozenge, with the acute angles in the horizontal, and the obtuse in the perpendicular, line of the whole body. Fig. 7† of Pl. XIV. shows the manner of the projections from the plait and the figure which the peculiar shape of their tops causes to be seen on a clean section exactly through the middle of any one. In all the specimens of this species which I have seen, the projections run in nearly regular spiral lines round the body.

On the inner surface of this and of some other broadly depressed species there is a very small and slight depression between each of the large depressions, and both on the plaits and on the places of the united bulgings. It is barely traceable, and

* This is a longitudinal section taken rather obliquely in order to preserve the roots. It is not quite regular therefore; but, on the side which is preserved, the projections can be well distinguished.

† In this figure I have connected the inner and outer plaits by brackets,—the outline of each merely being given for the sake of clearness.

may easily escape notice. It is however worthy of remark as an additional contrivance for gaining extent of surface, and an additional instance of the exhaustless variety of plan which nature adopts in the development of life.

6. *Cephalites retrusus.* Pl. XIV. fig. 8.

Plaits broad and very deep : outer plaits . . . . : inner plaits raised in rather small but very prominent projections at regular and close intervals, and in such manner that they range spirally round the whole body, and quincuncially relatively to each other : projections cylindrical, rounding off slightly at the top and with an exactly central and rather deep circular depression (sometimes two) on the top of each projection : wall very thick.

This form departs from every other which has been named. It is the first and only instance in which we find projections on the *inner* plaits, which have been already more than once found, and will be so again, on the outer plaits. The fold which marked the outer plaits of *C. bullatus* is here found, with striking modifications however, on the inside. The projections are much smaller and closer than in that species, but no less prominent; while each one is again marked by a deep though small and exactly central depression. It is altogether a very extraordinary form*. In chalk specimens it would at once be distinguished from every other species by presenting, on its inner surface, the appearance of a series of small rings, quite unconnected with each other, but arranged with the utmost regularity.

It is an extremely rare species. I have only met with a single specimen, and that is a cast of the inner surface in flint, with fragments of the characteristic ventriculitic structure preserved in

* Forms like this afford very strong ground of caution against the hasty adoption of any *development theories.* The whole of the present subject affords, indeed, the strongest ground for such caution. We see *infinite variety* —all subservient to the ends of life; and throughout which one Unity is traceable; but a Unity which certainly no more points to a low type of organization, or to a necessary or probable progressive development of one form from another, than does the beautiful and philosophical demonstration of the cranial vertebræ, or the fact of that demonstration being afforded by the most different members of the Vertebrata. It should be noticed that the very remarkable octahedral structure already developed as characteristic of the membrane of the Ventriculidæ has no relation whatever to those "geometrical figures" alluded to by Professor Owen. In the present case it is a *relative*, and not a positive, form; and one assumed by *animal fibre* for a special purpose. It has been already remarked (p. 96) that no spicules, or "calcifying salts" enter into the composition of any of the Ventriculidæ. See Owen "on the Archetype and Homologies of the Vertebrate Skeleton," 1848, p. 171.

places. I am unable therefore to describe the outer plaits. The characters of the inner ones are, however, so marked that those of the outer ones are quite unnecessary in order to establish the specific difference.

The name *retrusus* may be considered either to express the extraordinary degree in which the inner plaits are drawn back to form the projections; or that the most marked characters of the species are hidden from external observation by being on the inner plaits. In either sense the name seems equally appropriate.

7. *Cephalites catenifer.* Pl. XIV. figs. 9, 14, 15, 16.

Plaits broad and deep: outer plaits projecting prominently at irregular intervals; projections horse-shoe shaped, with one arm of a lower projection often linked to the hoop of the projection above it on the same plait; occasional points of anastomosis between adjoining plaits: inner plaits having large and generally oval depressions at regular intervals; bulging on each side around depressions till adjoining plaits meet and open into each other: processes very conspicuous: wall very thick.

Var. *Annulatus.*

Plaits broad and deep: outer plaits projecting prominently at irregular intervals; projections ring-shaped, and generally running into each other on the same plait and often anastomosing with those on adjoining plaits so as to form connected rings over the whole surface: inner plaits having large and generally oval depressions at regular intervals; bulging on each side around depressions till adjoining plaits meet and open into each other: processes very conspicuous: wall very thick.

This is a singular species. The specific name of the typical specimens exactly expresses the appearance of the outer surface, which looks as if several links of a chain were hung about it,—sometimes disconnected,—often connected,—always, or almost always, open on one (and generally the same) side.

This species will be readily distinguished from *C. bullatus* by the fact that the semilunar fold is continued down to the upper edge of the plait, as well as by the links being so often continuous, and by each individual projection being much larger.

Figs. 14, 15 and 16 of Pl. XIV., all taken from the same specimen, will probably assist in the understanding of this modification of the fold. Fig. 14 shows a part of the *core* of the matrix, that which filled the central cavity. The round spots are where depressions existed in the body itself, and where, consequently, the matrix projected outwards from the core. Being broken off at

each place, these regular marks are left, contrasting strongly with the portions of the membrane adhering to the matrix elsewhere*. Fig. 16, which should be compared with fig. 14 of Pl. XIII., shows the peculiar elevations on the plaits: and fig. 15 is a transverse section showing three plaits; the uppermost being struck at a point where there is not any projection, the two others just at the bend of two projections.

The specimens which I have distinguished as a variety, under the name of *annulatus*, appear to be cases in which the horse-shoe elevations have become more than usually continuous both on the same plait and by anastomosis with those on adjoining plaits. This character is sometimes seen on the lower part of specimens the upper part of which exhibits the true normal characters of *C. catenifer*, as in fig. 9. Pl. XIV. In some cases, however, the same appearance of connected rings, instead of rows of open links, covers a large part, or the whole, of the surface; and it is important that the true place of such specimens should be understood, whence the utility of distinguishing them as a *variety* of *C. catenifer*.

It generally happens that, even in the most characteristic specimens of this variety, there are places in which the projection on the outer plait stands, as it so often does in the normal *C. catenifer*, single and wholly unconnected with any other projection on the same or on any adjoining plait. In that case, instead of being horse-shoe shaped, the circle is usually complete. We thus find, on an external plait, a fold very similar to that which characterizes the inner plaits of *C. retrusus*.

8. *Cephalites compressus*. Pl. XIV. fig. 10.

Plaits broad and very deep: outer plaits projecting prominently in very elongated loops often linked at one extremity and enlarged at the other: inner plaits often inclining towards, and anastomosing with, adjoining plaits: pouch very short: processes very conspicuous: wall very thick.

This appears to be quite a distinct species from the last. Its fold is looser, approaching therein to the character of the group *Dilatati*. The external modification of fold is very different from that of *C. catenifer*; while the internal difference is even more marked. Instead of depressions we have here anastomosis with the adjoining plaits; and at the places of anastomosis the figure becomes almost angular, instead of circular as heretofore.

* See ante, p. 209, *note* †.

§ *b. Dilatati.*

Head broad and rounding: plaits loose and irregular.

All the species of the present section differ very remarkably from the *Annulati*. In the latter section the heads in all the species were of nearly the same size relatively to the size of the whole body; as also was the central cavity. The various differences of contrivance by which extent of surface was gained at the same time that the free access of sea-water was maintained, were found in the different modes of folding of the membrane of the wall. In the present section the character of the fold of that membrane differs also in the different species; but that difference is accompanied by very remarkable differences in the form and extent of the head. The latter becomes the most conspicuous instead of a mere subordinate part to the observer of the whole body. As, therefore, the difference in the heads is a necessary accompaniment of a difference in the fold of the membrane (though rather in the relation of consequence than cause), it will simplify the labour of the inquirer if the character of the head is adopted as one of specific difference. The names given have therefore a reference to this point.

It will be obvious that, the looser the folds, the more necessary would become the greater extent of cephalic membrane in order to secure the objects already suggested as those for which that remarkable structure was designed. Hence the variations in this conspicuous character in the forms immediately under consideration.

There are minor modifications in individuals of each species which would probably be held by many to justify the assignment of each species as a distinct genus; an arrangement which would indeed be far better warranted than many such divisions both in recent and fossil classifications. It does not seem to me however that the principles of a sound classification will, in the present state of our knowledge, justify such an arrangement*. Moreover, all the species of the present section are of extreme rarity; so rare, that it is very probable that few even diligent collectors will succeed in obtaining specimens of each, unless some bed abounding in them, and at present unknown, should be discovered.

1. *Cephalites capitatus*. Pl. XIV. fig. 11.

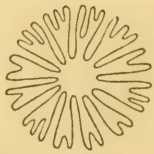
Plaits very deep; dividing longitudinally, and so reduplicating, very constantly, as they pass from the inner to the outer surface; points of anastomosis at irregular distances on both

* See ante, p. 41 *note*, and pp. 42, &c.

inner and outer surfaces: central cavity small: head rounding and very wide: wall falling in very rapidly but in a regular slope from outer margin of head to root: diameter of whole body greater than its height.

In some specimens of the present species the plaits are very traceable on the outside; in others much less so, on account of the almost total absence of oxide of iron. In each case, however, it is equally obvious that the number of plaits seen on the outer surface is given by the *longitudinal* division and reduplication of the plaits towards that surface, in the same way as the increase of plaits from base to margin has already been described as being effected by a *transverse* division and reduplication*. The accompanying figure will explain the present mode of this reduplication. This arrangement takes place to some extent in most of the *Annulati*, but the very small size of the central cavity in *C. capitatus* renders this peculiarity constant in this species, and one of its most marked characteristics.

Fig. G.



The general form of this species is so peculiar that a vertical section through the fossil displays a triangular figure, of which the base of the fossil forms an obtuse angle, while the external margins of the head form acute angles with the wall. It is thus impossible to confound this species with *C. compressus*, as the wall of that species, like that of every other species of the section *Annulati*, usually forms, inside and outside, nearly a right angle with the head†.

2. *Cephalites campanulatus*. Pl. XIV. figs. 12 & 13.

Plaits very deep; increasing very rapidly from base and dividing, and so reduplicating, very constantly, both longitudinally and transversely; after attaining the fullest expansion, folding inwards and downwards, and gradually contracting till they more or less nearly approach the base, whence, folded upwards in a single plait, the membrane rises, usually simple and plain, in a funnel form, to the margin of the head surrounding the central cavity, to which its marginal edge is attached: head enwrapping the body and attached to all the prominent plaits as far as the point where they incline rapidly towards the base: diameter of body greater than height.

* See ante, p. 213.

† I have an interesting specimen of this species in which two individuals are close together; actually *touching*. But they cannot be mistaken for an example of *C. constrictus*, each individual having separate roots or places of roots, (see before, p. 46,) and not being parts of one single body.

This species differs very widely in outward appearance from *C. capitatus*. In that species the head is indeed so largely developed as to be the most conspicuous part of the entire body; but it still leaves a view to some extent of the wall. In the present species the whole fossil, unless actually looked at from below, is so entirely enveloped by the cephalic membrane,—rendered necessary on account of the great depth and consequent tendency to looseness of the fold,—that no idea of the character of the membrane of the wall itself can be gained externally.

The modification of the fold is exceedingly remarkable, and exceedingly difficult to be ascertained. The description given, however extraordinary it may appear, is the result of very laborious and careful examination, comparison, and section of all the specimens which I have been able to obtain. A familiar illustration may perhaps assist in understanding the arrangement of this membrane. If the inquirer will glance at the hangings of any window, looped up, as usual, in festoons at some distance from the ground by curtain pins or ropes, he will see a contrivance rudely imitating the very elegant plan adopted by nature, to give, in a small space, a very great extent of surface combined with security to the polypiferous membrane of *C. campanulatus*. Take a piece of linen cloth: join together the side-edges along their whole length, gathering the lower edge to a point: fix the upper end of the sac thus formed* to a circular plain wire: at a third of the length from the bottom fix another wire, which, though altogether uniting in a circle, is deeply zigzaged: the upper wire remaining fixed, raise the lower wire equally all round, and so that the drapery hanging from the upper simply circular wire shall fall within, and that hanging from the zigzaged circle shall fall on the outside. Over both wires draw, smoothly, a separate cloth, to which fix both wires. Then, by holding the entire contrivance at any point of the plain wire circle, the whole will be retained in its place. Such a contrivance will afford the best idea of the very remarkable arrangement of the internal membrane of the present species, and of the object and importance of its deeply extended head. It is obvious that, if the lower wire were zigzaged, not only in its horizontal plane but also in a direction perpendicular to that plane, though it would affect the points at which the outer covering or envelope would be touched, it would in no wise affect the principle of the plaits or folds whose extremities touched that envelope. The following two figures may render this matter still clearer.

* To act properly, and to give a full idea of the extent of surface gained, the sac should be very much wider at the middle than at the top or bottom, in order to fill the lower zigzaged wire and yet inclose the plain fold of the cloth without compressing or touching it.

Fig. H.

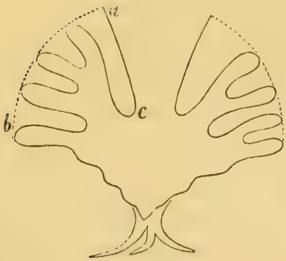
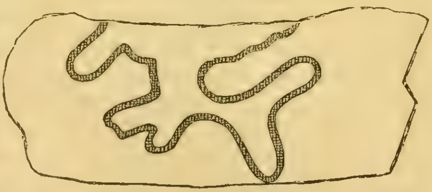


Fig. I.

In each figure the dotted line is the envelope. Fig. H is a longitudinal section as it would be seen if one could be taken exactly clear through any spot where there was no lateral division of a plait—the presence of which gives a false appearance of anastomosis to a section. It will be seen that the membrane may be traced from the point of the base to *c* and thence to *a* in a continuous line, and that the projecting plaits are affixed, at various points, to the envelope *a*—*b*. Fig. I is a transverse section taken about the middle of a specimen. The inner circle is the membrane where simple and unwaving, and forming therefore necessarily an unbroken circle. Between this and the envelope the plaits are seen, cut horizontally across.

The membrane begins to fold upwards in its last plait at different distances in different specimens from the inner margin of the head; and it is rarely that the folding upwards will take place on exactly the same plane all around; whence, on section, a deceptive appearance is often given, as if there were a double or triple or still more numerous ramification of the central cavity. This is seen in the following curious section of a flint of this species in my possession. Such cases only afford instances of the care and caution necessary in the investigation of such a subject as the present.

Fig. K.



It will be clearly seen that the mode of fold, of which an attempt has thus been made to convey an idea, secured free access of sea-water to all parts of the surface of the membrane, external and internal. By the same contrivance that membrane was held securely in its position; the regular funnel-shape assumed by the last plait, with its margin fixed at the top, securing it within *;

* See observations on the head, before, p. 282.

the campanulate envelope, to which the projecting points of the plaits were affixed, securing it without. The size of the internal cavity varies in different specimens, as will be seen by figs. 12 and 13 of Pl. XIV.; of which fig. 12 is a general view of the external aspect of one specimen; fig. 13 is a section, with the matrix cleared away from the inner funnel-shaped simple membrane, of another.

There is certainly no form among the Ventriculidæ which might, at first sight, be less supposed than the present to have had any affinity with the fossils which have been described as belonging to the genus *Ventriculites*. This will be well understood by comparing Pl. XIV. figs. 12 and 13 with any of the figures on Pl. XIII.

The condition in which these specimens are found,—their deep folds preventing their ever coming free from the chalk, or being developed without the laborious use of the needle,—renders it impossible to make any confident observations upon them as to the processes; a remark which also applies to every other species of the present section.

3. *Cephalites constrictus*. Pl. XV. fig. 1.

Whole body very low, much-elongated and narrow, with roots at one end: plaits very deep, and running longitudinally from the root extremity; each plait constricted at short and not very regular intervals, and sometimes to nearly its whole depth: cephalic membrane covering the whole upper surface and sides, to the margins of which last, as well as to many of the prominent points of the plaits, it is attached; usually constricted at considerable intervals, with a single opening in the middle of each compartment thus caused.

The specific description will satisfy the inquirer that this is a very extraordinary form. Externally it has nothing which would indicate any Ventriculitic affinity, and it has indeed been described by Dr. Mantell under the name of *Choanites subrotundus*; but it has no relation whatever to *Choanites*. The appearance of the fossils is so remarkable, that, but for the fixed rule of preserving every fragment which I could not understand, I should never have been able to establish or even suspect the true affinities. A suite of seventeen specimens enables me, however, now to point out the true general characters of the species without leaving any room even for doubt.

In the two very different states in which the fossil, or fragments of it, are found, it has very different appearances; the one state (see left hand of figure) shows the upper, the other (see right hand of figure) the lower part only, or its cast. The com-

parison of several of these apparently anomalous fossils led me however to conceive that the connected rounded bodies seen in the former set of specimens had some relation to the very peculiarly complicated and almost angularly raised surfaces seen in the latter. With this clue I cut down some of these rounded bodies, and found the identical surfaces last named below them. Several sections being made, and the whole series being then compared, order and method became at once apparent where all had previously been anomaly and confusion. The characteristic Ventriculitic structure was detected: the Ventriculitic fold was traced: and the Ventriculitic root was found.

I conceive the habit of the animal to have been very different in one respect from that of all the species which have hitherto engaged attention. While the latter stood rising upwards from a central root, this species, attached at one end by a root, and thus secured in its position, floated horizontally, like a ship riding at anchor. It had therefore no central cavity in the direction of its length, but, instead of this, it was covered by a head investing the upper and lateral surfaces of that whole length; and which head, with rare exceptions, for such exceptions do exist, was constricted at intervals, causing the animal, when seen from above and entire, as in the greater part of fig. 1. Pl. XV., to appear like several distinct globose bodies linked together. The fact of the head being occasionally, though rarely, not constricted at all, will satisfy any philosophic inquirer that such an appearance is deceptive, and that the explanation thus given of that appearance is the true one. Besides this, however, if the head be removed, and the lower surface of the fossil only seen, all trace of separation and distinctness is gone. The membrane of the wall does not divide into lobes, as in *Brachiolites*: there is simply, in order to ensure the greater security of the whole polypiferous surface, an occasional constriction of the head and narrowing of the plaits attached to it; which plaits expand again, like an open fan, in the following compartment.

The appearance of the plaits themselves is very remarkable. Their frequent constrictions give them a puckered or zigzag appearance, so that a vertical section has a figure of this kind. This figure shows, also, how the projecting points of the plaits are often attached, for security, to

Fig. L.

the head. When the body is broken away the cast left is very curious, the matrix being always broken off in many of the places where it has filled a pucker in the upper plait, depressed where there was a pucker in the lower plait. This is seen on the right hand of fig. 1. Pl. XV.

The species rarely attained half an inch in height or an inch in breadth, though specimens often extend between two and three inches in length.

It seems to me that the cephalic constrictions most probably mark periods of growth *. They vary in number much in different specimens, and, as has been seen, are sometimes not found at all, in which case there are several openings in the undivided head.

Specimens sometimes assume irregular forms, as if, after death, the long body had become twisted, which I have little doubt was, in many such cases, the real fact.

I have placed this species next in order to *C. campanulatus*, inasmuch as, on the one hand, the mode of attachment of the cephalic membrane to the plaits resembles very much that which is found in *C. campanulatus*, while, on the other hand, the fact of the openings in the head of this species being generally several instead of only one, places it in some relation to the species which will next claim attention.

4. *Cephalites perforatus.* Pl. XV. fig. 2.

Plaits wide and very deep, so as to leave no distinct and single central cavity; dividing, and so reduplicating, very constantly, longitudinally, but not transversely; somewhat winding both longitudinally and laterally; occasional points of anastomosis near the outer surface: head covering the entire top and rounding to some distance down the sides; having several small round perforations arranged without any regular figure: body of nearly uniform breadth and often twice the height of its diameter.

The peculiar arrangement of the plaits and head in the last two species rendered any anastomosis of adjoining plaits not essential in either of them. The much greater height of the present species rendered occasional points of anastomosis an important means of securing the permanence of the position of the folds. The width and depth of those folds rendered a large head necessary, while it made unnecessary any large single central cavity; the several small openings in the head giving sufficient access to the sea-water for the purpose of bathing freely all the internal surface of the polypiferous membrane. The unity of form † is not in the least degree impaired by the existence of these several points of access. The one head still holds in place all the several plaits, a contrivance for the security of the entire

* Specimens, apparently entire, are sometimes found, having one only of the rounded divisions, and thus bearing some resemblance to a very small *C. campanulatus*, with its root at one end instead of at the base.

† See before, p. 207 *note*.

animal and of the individual polyps wholly different from that which is found in every species of the family *Brachiolites*.

In all the various and so greatly varying forms which have been thus seen to be included in the genus *Cephalites* one end is found to be subserved, namely, the maintenance of the security of the whole mass, and of each individual of its myriads of living tenants; together with the unimpeded access of the sea-water—that element upon whose constant presence the life and subsistence of those myriads depended. The great diversity is no less striking than is, in each case, the completeness of the varying methods which nature has adopted for securing that ever-teeming, ever-active life which excites the inquirer's increased admiration at every step he takes.

[To be continued.]

XXX.—*Notes, &c. on the genera of Insects* Pissodes, Hypera, *&c.*; *with descriptions of several new species*. By John Walton, F.L.S.

Fam. CURCULIONIDÆ.

Genus Pissodes, *Germ.*, *Schönh.*, *Steph.*

1. *Pissodes Pini*, Linn., Gyll., Steph., Schönh.

Recently found in Scotland rather plentifully by Mr. Weaver; "on rails, in a fir-wood, Weybridge, in June," Mr. Smith; "under side of a fir-log, Dalmeny Park, Scotland," Mr. R. N. Greville; "under the branches and chips of the Scotch fir lying on grass, Gosforth Woods, Northumberland," Mr. T. J. Bold.

2. *P. notatus*, Fab., Gyll., Steph., Schönh.
— *Fabricii*, Steph., non Leach MSS.

Two specimens of this insect in the collection of the British Museum, taken in Scotland by the late Dr. Leach, appear to have been mistaken for the following by Mr. Stephens.

A single specimen found under a stone in an old gravel-pit at Yaxham near East Dereham, Norfolk, by Mr. Wollaston.

3. *P. piceæ*, Illig., Schönh.
— *Fabricii*, Leach MSS. sec. specim. Mus. Brit.

Oblong-ovate, piceous, sparingly clothed with flavescent scales. Head short, convex, obsoletely punctulated, front with a deep fovea between the eyes; rostrum nearly as long as the head and thorax, moderately stout, cylindrical, slightly curved, closely punctured, brown, and sprinkled with scales at the base. Antennæ scarcely reaching to the middle of the thorax, rather thick, rufo-piceous, setose and pubescent. Thorax considerably narrowed

anteriorly, dilated and rounded at the sides posteriorly, convex above, closely rugose-punctate, a slender abbreviated carinula on the middle of the back, and two remote foveolæ on the disc. Elytra elongate, punctate-striate, the punctures deep, oblong, remote, very unequal, small towards the base and apex, and much larger in the middle; the interstices closely rugulose, alternately broader and elevated; sprinkled with obscure lutescent scales, and with a broad unequal abbreviated fascia behind the middle composed of flavescent scales. Legs elongate, pale rufo-piceous, femora and tibiæ annulated with whitish scales in the middle. Length 4 lines.

There is one specimen of this insect, reputed to be British, in the collection of the National Museum.

Genus Hypera, *Germ.* (1821), *Curt.*, *Steph.*, *Westw.*
Phytonomus, Schönh. (1826)*, Spry et Shuck.

Great confusion has hitherto prevailed in this country as to the specific identity of the insects of this genus: although our catalogues contain from twenty-nine to thirty-one specific names, of which seven have been sunk into varieties and twenty-two described as specifically distinct by Mr. Stephens in his 'Manual of British Coleoptera,' yet, after a most rigorous comparative examination of numerous specimens, I have not been able to identify more than fourteen distinct species; I have therefore ventured to go further, by reducing eight more names into synonyms or varieties. It appears to me that British entomologists have relied too much on the colour and markings of the scales, and on the colour of the different organs of the body, as specific distinctions, but these characters in a majority of the species are extremely variable and consequently unsafe to depend upon. I have corrected the names of a few insects by means of well-authenticated foreign specimens, and in accordance with the authorities so often named in my former notes, which will I hope have a tendency to establish the nomenclature upon a uniform and permanent foundation.

1. *Hypera punctata*, Fab., et auct. alior.
Curc. medius et *austriacus*, Marsh., Kirb. MSS.

2. *H. fasciculata*, Herbst, et auct. alior.
— *sticticus*, Kirb. MSS.

Very rare and local: it has not occurred of late years to my

* I cannot find any reason assigned by Schönherr for changing the name *Hypera*; I have therefore, in accordance with the just law of priority, followed those British authors who have retained it; yet it is rather remarkable that Germar himself, with many other continental entomologists, have adopted *Phytonomus*. Latreille employed a similar name (*Hyperia*) for a genus of Crustacea, which occurs for the first time in 'Cuv. Règ. Anim.' iv. 1829.

knowledge. In the cabinets of the British Museum, Entomological Society, Curtis, Stephens and Walton.

3. *H. Polygoni*, Linn. sec. ej. Mus., Fab., Gyll., Steph., Schönh.
— *arator* var., Linn. sec. ej. Mus., Marsh., Steph. Ill., Kirb. MSS.
— *canescens* var. et *Viciæ* var., Steph. sec. ej. Mus.
— *picicornis* var., Steph. sec. ej. Man.

The male has the anterior tibia acutely dentate in the middle within. Of *Rhynch. Viciæ* of Gyll. I have never seen an indigenous specimen agreeing with the two foreign insects in the collection of Mr. Kirby.

Rather common; found in damp meadows near Lyndhurst, Battersea Fields, Arundel, Yorkshire, &c. in June.

4. *H. Pollux*, Fab., Gyll., Germ., Schönh.
— *alternans* var., Steph. Ill.
— *Kunzii* var., Steph. Man., non Schönh.
— *palustris* (Leach MSS.), Steph.
— *Julinii* (Sahlb.), Schönh., var. sec. Germ.
— *bitæniatus*, Kirb. MSS.

I sent many specimens of this insect to Germar, who has subdivided the varieties as follows:—

a. "With gray scales upon the elytra, and with small square spots arranged in rows—the true *Phyt. Pollux*, auctor.
b. "With brown scales; the elytra checkered with black, and with two broad, gray, black checkered longitudinal lines—*Hypera palustris* of Steph.
c. "Brown or black, with three gray unspotted longitudinal lines upon each elytron—*Hypera alternans* of Steph.; *Kunzii*, Steph. (but not Schönh.); *Julinii*, Sahlb.*"

Identified as *Rh. Pollux* of Gyll. by a foreign specimen in the collection of Mr. Kirby. I possess foreign specimens from Germar of *Hy. Kunzii*, which is undoubtedly a very distinct insect, and unknown as British. There is a fine series of varieties of *Rh. palustris* of Leach in the British Museum; also Mr. S. Stevens and myself have a long series of this insect.

Occasionally found on grassy banks, at the sides of ponds and ditches, in marshy places, but not plentifully, in June.

5. *H. Rumicis*, Linn. sec. ej. Mus., et auct. alior.
Procas pyrrhodactylus var., Marsh., Steph.
H. albicans, *griseolus* et *elongatus*, Kirb. MSS.

This insect in general habit and sculpture very much resembles the preceding; it may however be distinguished by having the rostrum gradually dilated from the middle to the apex.

Extremely common on docks in marshy situations.

* Ent. Zeit. no. 5. p. 100, 1842.

6. *Hypera murina*, Fab., Gyll., Germ., Schönh.
   — *Pollux* et *elongata* var., Steph. sec. ej. Mus.
   — *nebulosa* var., Steph. sec. ej. Man.
   — *fusco-cinereus*, Marsh. sec. Mus. Steph. et Kirb.
   — *interruptus*, Marsh. sec. Steph. Catal.
   — *dorsiger*, Kirb. MSS.

This is a larger insect than any of its congeners, and chiefly distinguished by having the thorax subglobose, greatly dilated and rounded at the sides; the elytra elongate, nearly four times as long as the thorax.

Rare; found in damp grassy places. Plumstead, Barnes Common, Mr. S. Stevens.

7. *H. tigrina* (Dej.), Schönh.
   — *elongata*, Curt. MSS.

Elongate, black, thickly clothed with cinereous and silvery white scales, and with white and fuscous hairs. Head short, convex, closely punctulated; eyes oblong, depressed; rostrum rather longer than the thorax, subcylindrical, slender, curved and punctulated, clothed with hair before the base in the male. Antennæ inserted before the middle of the rostrum, rather longer than the head and thorax, rufo-ferruginous, pilose; clava oblong-ovate, obscure black. Thorax subdepressed, broader than long, considerably dilated, and rounded at the sides a little before the middle, closely and minutely punctured; a broad stripe on each side and a line of silvery white scales down the middle. Elytra oblong-ovate, four times as long as the thorax, the shoulders prominent, obtusely rounded, moderately convex above, distinctly striated, the striæ closely and minutely punctured, the interstices narrow, convex, transversely rugulose; thickly covered with cinereous or silvery white scales, and a series of large subquadrate black spots alternating with white ones on the suture, and with black spots arranged in rows on the alternate interstices rather indistinct anteriorly but distinct posteriorly. Legs long, black; femora moderately clavate, simple, squamulose; tibiæ round, pubescent; tarsi elongate, piceous. Length 3 lines.

This very distinct insect may be discriminated, by having a longer rostrum than any other of the genus, by having the thorax laterally dilated before the middle, and the elytra spotted with black scales.

I understood Mr. Curtis that three specimens, all nearly alike, of this new British insect, were found near Dover, one of which I have seen in his cabinet. A single specimen was taken in the same locality by Mr. Marshall the latter end of July.

8. *Hypera Plantaginis,* DeGeer, Gyll., Steph., Schönh., Kirb. MSS.
 — *villosula** (sec. Mus. Wilk.), Steph.
 — *cordicollis,* Kirb. MSS.

Occasionally found in several localities by brushing amongst grass, but never in any numbers.

9. *H. nigrirostris,* Fab., et auct. plur.
 Common everywhere.

10. *H. trilineata,* Marsh., sec. Mus. Steph. et Kirb.
 — *Trifolii,* Steph., non Herbst.
 — *stramineus* var., Marsh., Steph. sec. ej. Man.
 — *borealis,* Germ. Mag. iv. p. 339.
 — *nigrirostris* var., Gyll., Schönh.
 Curc. dissimilis var. *major,* Herbst.

Never clothed with brilliant green scales like *Hy. nigrirostris,* and may further be distinguished from the varieties of that insect by having a dark denuded stripe on the middle of each elytron posteriorly, bordered within and without by a series of white or fuscescent spots: as to the form, size and sculpture it very closely resembles the foregoing.

Although Gyllenhal and Schönherr have cited this insect as a variety of the preceding, yet I concur with Germar that it is sufficiently distinct.

Common in the North of England on the different species of *Vicia, Trifolium* and *Medicago.*

11. *H. variabilis,* Herbst, et auct. plur.
 — *sublineata* (var. sec. Mus. Kirb.), Steph.
 — *bimaculatus,* Marsh., Steph. sec. ej. Mus.
 — *villosula* (sec. Mus. Wilk.), Steph.
 — *stramineus,* Marsh. sec. Mus. Kirb.
 — *phæopa* var. et *rufipes* var., Steph. sec. ej. Man.

Very abundant on the same plants as the last.

12. *H. meles,* Fab. sec. ej. Mus., Germ., Schönh.
 Rh. Trifolii, Gyll.
 Curc. Plantaginis, Marsh. sec. Steph. Catal.
 H. murina, Steph.
 — *picipes* var., Steph. sec. ej. Man.

This insect differs from the preceding by having the thorax very short, and much more dilated at the sides.

There are foreign specimens which agree with it in the cabinet of Mr. Kirby from Gyllenhal.

Rare in the vicinity of London. Taken near Ross, Herefordshire, by Mr. Spry.

* This synonym is repeated under No. 11, because it is represented in Wilkins's cabinet by two different insects.

13. *Hypera suspiciosa*, Herbst, Germ., Schönh., Steph. Man.
Curc. miles, Pk., Gyll., Steph.
— *pedestris*, Pk., Gyll., Steph., var. sec. Germ. et Schönh.
— *bitæniatus*, Marsh.
— *senex*, Kirb. MSS.

Variable in form : the narrow elongate varieties have been mistaken for *Curc. elongata* of Gyll., of which there are foreign specimens in the cabinet of the Rev. F. W. Hope.

Frequently found in damp meadows and in marshy places.

14. *H. Arundinis*, Fab., et auct. alior.
Rhynch. Sii, Leach MSS.

Extremely rare; I do not possess a specimen, nor have I heard of any recent captures : there are examples in the cabinets of the British Museum, Entomological Society, Mr. Stephens and Mr. Curtis.

Genus Limobius, *Schönh.**
Hypera, Germ., Steph., Curt.
Phytonomus, Schönh. olim.

Char. Gen. Antennæ moderate, rather slender, eleven-jointed; scape moderately incrassated towards the apex, reaching to the eyes; funiculus six-jointed, the first longer and stouter than the second, third obconic, fourth and fifth nodose, sixth cup-shaped; clava ovate or oblong-ovate, four-jointed. Rostrum twice or three times as long as the head, rather stout, rounded; scrobes oblique, somewhat deep. Eyes lateral, oval, more or less prominent. Thorax, base and apex truncate, dilated and rounded at the sides. Scutellum minute. Elytra ovate or oblong-ovate, the shoulders obtusely angulated, moderately convex above, densely clothed with scales.

Obs. Closely approximating to the genus *Hypera*, but the funiculus of the antenna is only six-jointed.

1. *Limobius dissimilis*, Gyll., Germ., Schönh.
Hypera fulvipes, Steph.
— *fumipes*, Curt. Ann. Nat. Hist. v. p. 280.

I found many specimens of this insect upon *Geranium pratense* growing on hedge-banks near East Tanfield, Yorkshire, in July. Taken in Scotland by the Rev. W. Little; Newcastle, Mr. S. Stevens.

2. *L. mixtus*, Schönh.

Oblong-ovate, black, thickly clothed with metallic brown or cinereous scales, variegated with white and black, and with short suberect black hairs. Head short, convex, thickly punctulated;

* Mant. secund. Fam. Curc. p. 44. Holmiæ, 1847.

eyes oviform, rather prominent; rostrum as long as the thorax, round, thickish, bent, and closely punctulated. Antennæ inserted near the apex of the rostrum in the male, and between the middle and the apex in the female, testaceous; clava oblong-ovate, obscure, testaceous. Thorax as broad in the middle as long, a little more narrowed before than behind, moderately dilated and rounded at the sides, rather convex above, closely and delicately punctulated; clothed with brown scales, a large rhomboidal pale patch on the disc, and a broad whitish line on each side. Elytra ample, oblong-ovate, shoulders very prominent, obtusely rounded, punctate-striate, interstices rugulose; thickly clothed with conico-ovate scales, two subquadrate velvety black spots at the base, a short white line on the scutellum, an oblique pale vitta down each elytron, broadest on the shoulders, spotted with black on the margins, and united beyond the middle to a transverse irregular silvery white fascia, which is joined to a subtriangular velvety black one. Legs moderate, rufo-testaceous, pubescent; tarsi elongate. Length $1\frac{2}{3}$—2 lines.

Exclusively of the six-jointed funiculus to the antennæ, this insect is well characterized, by the conspicuous velvety black fascia on the elytra, combined with the conico-ovate scales.

Varieties occur with gray or silvery white scales, and these being more subject to abrasion, are frequently found partially denuded, and the spots and stripes more or less obscure; others occur of a brassy yellow, with the markings distinct, and the body and legs pale testaceous.

Many specimens of this insect were found on *Erodium cicutarium* on the Chesil Bank, Isle of Portland, in June, by Mr. Wollaston, to whose indefatigable industry, we are indebted not only for this, but for many other additions to the British fauna; subsequently found in the same locality by Mr. Bowerbank and myself in September.

Genus Tropiphorus, *Schönh.*
Barynotus, Germ., Schönh. olim, Steph.

Char. Gen. "Antennæ moderate, rather slender; scape clavate, extending beyond the eyes; funiculus with the two basal joints somewhat long, subclavate, remainder rotundate; clava ovate, acuminate. Rostrum shortish, stout, subcylindrical, a little incrassated towards the apex, carinated above; scrobes curved, evanescent before the eyes. Eyes rounded, depressed. Thorax truncated at the base and apex, rotundate-emarginate beneath adjoining the neck, the sides straight at the base, rounded anteriorly, narrowed in front, carinated above. Scutellum none. Elytra short-ovate, when closed emarginated interiorly at the

base, shoulders scarcely prominent, with an elevated carina towards the apex of the suture. Femora clavate, unarmed.

Obs. "Allied to the genus *Barynotus*, but chiefly differs in having the rostrum and thorax carinated; and without a scutellum."—Transcribed from Schönherr.

1. *Tropiphorus Mercurialis*, Fab., Gyll., Schönh., Newm.
   Curc. Æcidii var., Marsh., Kirb. MSS.
   Barynotus Mercurialis var., Steph.
   — *Terricola* var., Newm. Ent. Mag. v. p. 173.

I have found many specimens of this insect on *Mercurialis perennis* in a shady wood near Mickleham, Surrey, in June, which have the alternate interstices of the elytra distinctly elevated. I have also found many specimens by brushing amongst grass in meadows, and in moss in the woods of Yorkshire, that have the alternate interstices of the elytra scarcely or very slightly elevated, but agreeing exactly with the former in every other character; the latter are considered by Gyllenhal and Schönherr as varieties, and after a most careful examination of numerous specimens I have no hesitation in citing them as such.

I possess foreign specimens from Germar.

Genus Barynotus, *Germ., Schönh.*
Merionus, Steph.

1. *B. obscurus*, Fab., Gyll., Germ., Steph.
   — *pilosulus*, Marsh.

2. *B. mœrens*, Fab., Herbst, Germ.
   — *elevatus*, Marsh., Steph.

Genus Otiorhynchus, *Germ.*

O. ebeninus, Schönh.

Elongate-ovate, black and shining. Head short, broad, a little convex, obsoletely punctulated posteriorly, front rugose-punctate, with a deep round fovea; eyes round, brown, moderately prominent; rostrum rather longer than the head, stout, angulated, dilated at the apex, rugulose-punctate above, with a carinula in the middle a little elevated and obsoletely bifid anteriorly. Antennæ half the length of the body, black or piceous, pilose and pubescent. Thorax somewhat longer than broad, equally dilated and rounded at the sides, convex above, subpulvinate, closely tuberculated at the sides, punctured or remotely punctured on the back, totally black and glabrous. Scutellum short, triangular. Elytra elongate-ovate, not broader anteriorly than the base of the thorax, a little expanded before the middle, attenuated posteriorly, acutely rounded at the apex, four times longer than

the thorax, convex above, distinctly punctate-striate, the punctures rather large, remote, angulated, the lateral interstices tuberculated, obsoletely rugose on the back, totally black and shining. Body black beneath, granulated and cinereo-pubescent anteriorly; abdomen punctulated. Legs rather long, stout, black; femora robust, clavate, simple; tibiæ pilose; tarsi dilated, piceous, clothed beneath with a flavescent pulvillus. Length 5 lines.

This insect may be placed in the genus next to *Otiorhynchus tenebricosus*, to which it is nearly related.

I have a foreign specimen of *Ot. ebeninus* of Schönherr from Germar.

Four specimens of this insect, which is new to the British fauna, were found by Mr. R. N. Greville on the west highlands of Scotland, to whose liberality I am indebted for a specimen.

XXXI.—*Notes on the Species, Structure, and Animality of the Freshwater Sponges in the Tanks of Bombay.* (*Genus* Spongilla.) By H. J. Carter, Esq., Assistant Surgeon*.

There are four† species of Freshwater Sponges in the Tanks of Bombay, each of which is readily distinguished by the following characters:—

Two are known from the other two by the peculiar form of the spicula which encrust their seed-like bodies.

1. Is darkly cinereous or mouse-coloured when dry, purplish under water when alive, encrusting, repent, spreading in circular patches when isolated; smooth or interrupted by gentle eminences on the surface, attaining the thickness of half an inch in the centre, oscula tending towards a quincuncial arrangement; texture compact, fine, delicate; structure rectangularly reticulated; friable. Seed-like bodies spherical, 1–67th of an inch in diameter. Spicula of two kinds, large and small; large spicula smooth, slightly curved, pointed at each end, 1–80th of an inch long; small spicula straight or slightly curved, thickly spiniferous, 1–400th of an inch long.

2. Is of a faintly yellow or bright green colour, encrusting, repent, spreading in irregular patches on fixed bodies, globular when surrounding a floating nucleus; even or interrupted by gentle eminences on the surface when fixed, presenting meandering ridges and sulci when attached to floating bodies; attaining the thickness of half an inch when fixed, of two inches when floating; texture coarse and open, structure rectangularly reticulated with a suberose crust slightly tenacious. Seed-like

* Reprinted from the Transactions of the Bombay Medical and Physical Society of 1847, and communicated by the Author.

† See Postscript at p. 310.

bodies spherical, 1–36th of an inch in diameter. Spicula of two kinds, large and small; large spicula smooth, slightly curved, pointed at each end, 1–57th of an inch long; small spicula smooth or thickly spiniferous, slightly curved or straight, 1–200th of an inch long. Transparent portions of investing membrane abounding in the small spicula.

3. Is of a light yellow colour, massive, spreading, convex, with short irregularly formed conical projections on the surface, or meandering ridges with sulci between them, attaining a thickness of two inches; texture fine; structure fibrous, plumose, obliquely reticulated towards the base, rectangularly reticulated towards the circumference; friable. Seed-like bodies spherical and 1–40th of an inch in diameter. Spicula of two kinds, large and small; large spicula smooth, slightly curved, pointed at both ends, 1–57th of an inch long; small spicula composed of a straight portion, sometimes slightly spiniferous, terminated at each end by a toothed disc with its points recurved or horizontal; the central portion is 1–400th of an inch long, the discs 1–600th of an inch in diameter.

4. Is of a bright yellow colour, massive, spreading, horizontal on the surface, with projecting, plumose, irregular portions, attaining a thickness of about two inches; texture coarse, loose; structure fibrous, branched, plumose, obliquely reticulated; semi-friable, may be compressed with the hand in water without undergoing much injury. Seed-like bodies ovoid, 1–28th of an inch in their long diameter, and 1–50th of an inch in their short diameter. Spicula of two kinds, large and small; large spicula smooth, slightly curved, pointed at each end, 1–66th of an inch long; small spicula 1–300th of an inch long; consisting of a straight portion, terminated by a toothed disc at each end, with its points recurved or horizontal, 1–950th of an inch in diameter. Transparent portions of investing membrane abounding in little siliceous stellated bodies, their arms projecting from a central cell, tapering to a point which ends in a stellated circle of recurved spines; they are 1–600th part of an inch in diameter.

The measurements of the seed-like bodies and the spicula are taken from the average size of the largest of their kind.

Habitat.—On the inclined and under surfaces of rocks, or attached to floating bodies in the tanks of Bombay; never at the bottom, and sometimes so high up as to be only covered by water three or four months in the year.

Investing membrane.—The investing membrane of the Freshwater Sponge, like the skin and the mucous membrane in the human body, is continuous throughout; and, like a shut sac, surrounds the parenchymatous structure and spicular skeleton of the whole mass, without inclosing it. In some instances it

abounds in spicula, as in No. 2, where they are mostly spiniferous, and in No. 4, where they are of the curious stellated form described. There are also, in addition, little sac-like bodies which are ever changing their form and vibrating particles, both of which will be hereafter mentioned. If a portion of the membrane be carefully held before the blowpipe under a red heat, the animal matter may be driven off, while the forms of the bodies mentioned appear to remain unaltered; sometimes even a siliceous skeleton of the membrane itself may remain, so thoroughly does silex pervade every portion of its structure. But there is a transparent reticulated network (probably filamentous) which can only be seen when the membrane is fresh.

Spicula.—The smooth spicula and the spicula terminated by toothed discs are hollow. In the smooth spiculum the form of its cavity may be seen by charring the animal matter which lines its interior. It will be found to be wide in the body of the spiculum, and to terminate abruptly at each end in a linear continuation. I have not been able to see it in the spiniferous spicula, on account of the number of little spines which encrust them.

The small spicula in each species are principally derived from the crusts of its seed-like bodies. In all the species the spicula are siliceous, and the largest are so much alike that they are of no use as a specific distinction.

Seed-like bodies.—The seed-like bodies are spherical or ovoid, according to the species. They all present an infundibular depression communicating with their interior; when young they are transparent and filled with minute granules like the vibrating bodies to be hereafter mentioned; as they get older, a crust of siliceous spicula, arranged perpendicularly to their surface, is secreted from their external membrane; it is from this crust that the small spicula in the different species are principally derived. In Nos. 1 and 2 they are straight, or slightly curved, and spiniferous. In Nos. 3 and 4 they are straight, sometimes spiniferous, and terminated at each end by a toothed disc; the discs of their free extremities surmount little papillary projections on the surface of the seed-like body, and they present a hole in their centre, which communicates with the cavity of the spiculum on which they are supported; their fixed ends are applied by a similar disc to the silicifying or external membrane of the seed-like body. The latter is coriaceous, and presents a hexagonally tessellated appearance, on which rest the fixed discs of the spicular crust. I could not perceive any holes in the centres of these hexagonal divisions.

Before the seed-like body arrives at its state of maturity, it is filled with minute granules suspended in a viscid transparent

fluid; afterwards these are parcelled out into spherical transparent cells, equal in size and very numerous; what becomes of them then I cannot say; but I have often observed in the reticulated structure of the dried Spongilla, a group of the spicula of the seed-like bodies, thrown together in an irregular manner, and I would infer from it, that, when the young Spongillæ are sufficiently advanced to be capable of supporting an independent existence, the seed-like body containing them is burst, and all traces of it disappear, except the group of spicula mentioned;—and, for the young Spongillæ, it appears to me that, some time after they have been liberated, they become stationary, and passing into the form of a seed-like body, ultimately end in being the reproductive sacs of their own species.

Most of these seed-like bodies, although they have been exposed in a piece of sponge to the direct rays of a tropical sun for a whole year, on a black dry rock, will, on being cut open, present a fresh-looking, yellow, transparent, viscid granular matter in their cavities, not unlike the yolk of a hard-boiled egg. They do not appear to possess in themselves any power of locomotion, and their being transported from place to place, or their adhering to the perpendicular or inclined surfaces of bodies, may depend upon the presence of one or more of the little animals I am about to describe.

Animality.—As to the animality of the Freshwater Sponge, I think there can be no doubt whatever. Look, for instance, at a ragged portion of it, torn off with a needle (under a magnifying glass of one-tenth of an inch focus), and it will be seen gradually to assume a spheroidal form; and if there be a spiculum near, it will embrace it within its substance; it may be seen even to approach it, and as it were spit itself upon it: still watch it, and it may bear away the spiculum; and then regard its circumference, and on it will be observed little papillæ, which gradually vary their form, extending and retracting themselves, until one of them may be seen to detach itself from the parent mass and go off to another object. This little animal, one of the group which it has left, may remain stationary on the second object, or descend to the watch-glass, assuming in its progress all forms that can be imagined, spheroidal or polygonal, while every point of its body appears capable of extending itself into a tubular attenuated prolongation. When dead and dry on the watch-glass, it is sometimes transparent, sometimes filled or surrounded by granular bodies, and though frequently irregular in shape, its natural form appears to approach nearest to that of a Florence flask, sometimes more, sometimes less globular; it is then (though its size varies with its age) about the one-thousandth part of an inch in diameter, not including the elongated portion, which in

length is about one quarter of the diameter of the body, and apparently corrugated like the neck of the entozoon *Cysticircus longicollis*. These transparent little sacs (the gemmules of Grant and Hogg?) are sometimes filled with green matter. They appear to be able to adapt themselves to any form that may be convenient for them to assume, and when forcibly separated from each other (by tearing to pieces a minute portion of the sponge under water in a watch-glass), the isolated individuals may be seen to approach each other, and to apply themselves together in twos and threes, &c., and so on, until, from a particle only discernible by the microscope, they assume the form of an aggregate visible to the naked eye, and such a portion, growing and multiplying, might ultimately reach the size of the largest masses adhering to the sides of the tanks at Bombay. They appear to belong to the genus *Amœba* of Ehrenberg. Dujardin has recognized them, and they are correctly figured (as they appear under a lens of one-tenth of an inch focus) in Johnston's 'British Sponges,' p. 61;—as well as certain filaments, which the day after a piece of sponge has been treated in the way which I have just mentioned, may be seen extended from them, terminating or not in little transparent bulbs; floating, or fixed by their extremities, branching irregularly, long or short, each branch terminating or not in a bulb, and presenting similar pedicellated bulbs here and there in its course; when fixed on the watch-glass, disposed irregularly in straight lines intersecting each other,—radiating from a common centre or bulb, or in the form of an areolar membrane; frequently moniliform, as if they grew by the addition of cells to their free extremities.

The aggregated position of the animals I have described, imbedded in the transparent tissue of the sponge, bears a great resemblance to that of some of the Compound Tunicated Animals; especially in their ultimate development into a mass, intersected in all directions by canals, to allow of the presence of that element which is necessary for their existence,—the freedom they possess in the early part of their life, of moving through the water or creeping over the surfaces of solid bodies, and their ultimate destination of becoming permanently fixed in a granulo-gelatinous mass, secreted or formed by themselves.

There is also a curious fact connected with the vitality of the Freshwater Sponges, and I think it also prevails with the Sea Sponges, for it was by observing the latter and their seed-like bodies, in the amorphous species, that I was first led to notice it. It is, that they may be taken out of their natural element, dried, and kept for months, without losing their vitality. This I have inferred from observing the sponges attached to the rocks on the upper parts of the tanks, which are uncovered for many months

of the year (indeed the greater part of it), to be now again in the full performance of all their vital functions. I have not yet been able to prove it entirely to my satisfaction by direct experiment, but, on the sides of a finger-glass in which I placed an old dried portion of No. 1, about a month since, changing the water daily, there are now growing atoms of new sponge visible to the naked eye, and there are large portions of the original mass adhering to other objects in the same vessel; but I have not yet been able to satisfy myself of the presence of new tissue in the latter.

Supplementary note.—Since writing the above "Notes," I have had the pleasure of reading Mr. Hogg's "Observations on the *Spongilla fluviatilis*," &c., published in the Transactions of the Linnæan Society, vol. xviii. part 3rd, wherein he advocates the opinion of its vegetable nature; but when, in support of his views, he quotes Dr. Johnston's remark on Dujardin's experiments, p. 396,—viz. that "locomotion is no proof of animality; several *Algæ* are locomotive;"—it must of course mean such movements as do not appear to be directed by an instinctive power; for there are certain changes of form accompanying locomotion which convey an impression to the mind of the presence of a guiding influence, beyond anything that is met with in the vegetable kingdom, and which would seem to require no additional evidence to prove to the observer that he is regarding motions peculiar to animal life. Such appear to me to be evinced by the young Spongillæ.

Moreover, I have ascertained by experiment, that when the transparent spherical capsules which contain the granules within the seed-like bodies (in No. 4) are liberated (by breaking open the latter under water in a watch-glass), their first act is to burst: this takes place during the first thirty-six hours; and their granules, which will presently be seen to be the true ova of a proteaniform infusorium, varying in diameter from about the 1–4300th part of an inch to a mere point, gradually and uniformly become spread over the surface of the watch-glass. On the second or third day (for this varies), each granule will be observed to be provided with an extensible, pseudo-pediform base; and the day after most of the largest may be seen slowly progressing by its aid, or gliding over the surface of the watch-glass in a globular form, by means of some other locomotive organs*. During the time that these changes are going on, the smaller granules, most of which also have an extensible base, amass themselves together in irregularly formed portions of granulo-gelatinous matter, while a few of the more matured animals, averaging 1–300th part of an inch in length when extended, may generally be ob-

* The same changes take place in the granular matter from the dried seed-like body.

served creeping about, singly or in pairs, with a number of globular bodies within them, varying in diameter from the 1–2150th to the 1–1075th of an inch; similar bodies also may be seen here and there, singly or associated together, fixed to the watch-glass by a plastic granulo-gelatinous matter, and bound down by filamentous threads (such as I have before mentioned) parting from them in different directions. After some days, from being nearly transparent in the first instance, the granular matter with which they are filled becomes more defined and evident, and as they enlarge, their circumference presents a cortical investment like that of the seed-like bodies; their colour also becomes brownish, and their circumference, from being at first smooth and defined, rough and irregular; they appear to be motionless in themselves, however much the matter contained within them may assume different shapes, and that peculiarity connected with their size and general appearance is quite sufficient to distinguish them from the granules of the matter in which they are imbedded. In the different stages of development I have mentioned, these bodies may be viewed, both within and without the more matured Protean, but, as I have not yet seen them deposited or fixed to the watch-glass by the animal itself, I am unable confidently to state that they contain its proper ova; should they prove to do so hereafter, the assumption that the animal itself ultimately passes into the form of a seed-like body may not be worth much.

The development of the ovum appears to take place in the following way:—When first liberated from the spherical cells of the seed-like bodies, it consists of an ovoid or globular sac of greenish homogeneous matter, surmounted by a red spot, and inclosed within a transparent envelope; the former then changes in shape, becomes granular, and its granules obtain a certain latitude of motion; thus transformed, it occupies and projects above the upper part of its transparent envelope, which in its turn enlarges and becomes spherical. Should the ovum in the commencement not have been firmly bound down by the filamentous structure to which I have alluded, the granulo-plastic matter, and the agglomeration of the minute vibrating bodies which accumulate around it, and which appear to be actively engaged in this part of the process, it may become vagrant; but if otherwise, it has probably become fixed for the whole period of its existence; unless, as I have observed in some gemmules when kept in distilled water, that the whole community appear to find it necessary to separate and forsake their spicular structure to go in search of food.

The form of the young Proteans from the granular matter taken from the seed-like bodies of Nos. 2 and 4 resembles *P.*

diffluens (Müller)*; that which chiefly accompanies No. 4 is of the figure given by Dujardin, to which I have already had occasion to allude; while the vibrating bodies themselves, when combined, take on the appearance of minute Proteans, and every particle of the fixed transparent granulo-gelatinous matter, which serves as a nidus for the whole, appears to be endowed with the power of continually extending, retracting, and altering its shape.

I have further observed, that the granulo-gelatinous transparent matter has in some places arranged itself into the forms of full-sized spicula, disposed in linear continuation, over-reaching each other side by side, just as they are seen in the fibrous structure of the old sponge; their surfaces however are not yet silicified; nor should I expect this to take place, as my experiments have been conducted with distilled water, had not Dr. Grant mentioned that siliceous spicula were formed in the gemmules of Spongilla which he nourished with rain-water.

Thus does every step towards the ultimate structure of the Freshwater Sponge, every form that is taken by the living matter of which it is composed, appear still more nearly to approximate it to the nature of the genera of Ehrenberg's *Pseudopodia*.

In a subsequent communication received from the author, he observes, that he has confounded two species under the head No. 2, and that the bright green coloured species there mentioned is distinguished from all the rest by having a crust of double-pointed *smooth* spicula round its seed-like bodies. He supposes this to be *Spongia lacustris* (Linn.), *Spongilla friabilis* (Lam.).

Further, he observes respecting the animality of the Freshwater Sponges, that the animals of which they are but a congeries are identical with the infusorium *Proteus*; 1st, because they are composed of a semi-transparent gelatinous matter; 2nd, because this gelatinous matter is endowed with the power of altering its shape and of locomotion; 3rd, because in it are seen transparent cells (*contracting vesicles*) of various diameters from 1-9000th part of an inch to a mere point (which he formerly supposed to be sphinctral orifices), dilating and contracting themselves as in other animalcules; and 4th, because this gelatinous matter is provided with greenish yellow granules moving with, and especially characteristic of both the *Proteus* and the animal of the sponge.

He regards the *Proteus* as being more active in changing its shape, &c. than the animals of the sponge when first torn from each other, from the habits of the former having been vagrant

* Blainville, Manuel d'Actinologie (Atlas, pl. 11. fig. 12).

perhaps from the commencement and its full development thereby having been unimpeded, and states that the *Proteus* feeds upon its like as well as upon other matter, inclosing its food within its own substance after the manner of the *Hydra*.

While examining the transparent border of a portion of sponge growing from the seed-like bodies, he has observed the contracting vesicles distinctly, and a little within this, the animals themselves distinguishable, though amassed together and ever changing their form; but he does not appear to have ever seen them inclose an object within their substance after the manner of the *Proteus*.

In the development of the contents of the sporangia or seed-like bodies, he observes, that when the latter are opened under water in a watch-glass, the transparent cells within them, having been eliminated, swell and are bursted by the imbibition (*endosmose*) of that fluid; and that then the true ova of the Sponge with which they are filled, spread themselves over the surface of the vessel. Each ovum appears, not to be globular or ovoid as he formerly supposed, but discoidal, very much resembling in size and appearance the globules of the blood, it being only when they are turned on their edges that they appear ovoid. The red spot in their centre he also now thinks to be an optical illusion, while he has every reason to believe that the ovum retains its planiform state until its transparent vesicles and granules have become developed and the power of locomotion in it fully established.—Ed.

BIBLIOGRAPHICAL NOTICES.

Rare and Remarkable Animals of Scotland, represented from living Subjects; with practical Observations on their Nature. By Sir John Graham Dalyell, Bart. Volume first, containing fifty-three coloured Plates. London: John Van Voorst, Paternoster Row, 1847. 4to. Pp. 270.

[Continued from p. 139.]

The most interesting chapter in this interesting volume is that which narrates the history of the *Hydra tuba*. This marine animal is called a Hydra by our author because it has the form and the characters of the freshwater polypes, and possesses also their qualities—their greed of living prey (p. 87), their proliferous evolution of young, their endurance of privations, their power to recover from apparently immedicable wounds, and their strange germinations and monstrosities under the influence and direction of the experimentalist (p. 93). This hydra is found attached to submarine bodies; the body is fleshy, inversely conical, encircled on the oral disc with

a series of long slender thread-like tentacula,—and thus it lives apparently for an indeterminate period, exercising all the functions of a perfect and adult animal even to the repeated production of young in all respects alike to the parent. So it lives until, from some unknown causes, a change comes over it, and it begins to unveil itself, and to exhibit one of the most wonderful revelations in animal transmutations. A pendulous column or roll is observed as if implanted on the disc of the hydra; at first it is faintly indented by circles and is terminated by a circular row of tentacula; the indenting circles become more deeply waved, the tentacula shorter until they are obliterated; and then each roll of the column is successively separated and liberated from the others until the whole embryonic column is dissolved, the individual rolls floating at freedom in the bosom of the waters, obviously the young of one of those large Medusæ which swarm our seas in the months of the latter summer and autumn!—Now this short sketch of the metamorphosis is not of any new discovery, for Sars had made us in some degree acquainted with it, but the account of it given by Sir John Dalyell excels all others in fullness and completeness, and in its freedom from conjectural explications. The metamorphosis itself is wonderfully curious, but what strikes us as the most unaccountable fact in the process is the uncertainty of the periods at which the change shall take place. The *Hydra tuba* shall remain for years a hydra propagating its kind, and we know of no data to fix the period when it shall begin the process of change into its mature and final state; and, to add wonder to wonder, having cast off several of these medusean embryos, a basis remains out of which another *Hydra tuba* shall arise, to go through the same hydra life and the same medusean metamorphoses as its predecessor. We suppose that these facts—for facts they are—will not support the opinions of Steenstrup on alternating generations, nor can even be reconciled with them.

The way in which Sir John discovered that the *Hydra tuba* was the embryo of a Medusa was this: he took a large Medusa, of undetermined species but beautifully figured on plate 15, and placing it in a vase of sea-water the spawn—" a brownish matter like dust"—was shed from its ovarian fringes and settled at the bottom. This spawn consisted of " an host of animated creatures in quick and varied motion," partaking much of the nature of the *planules* of the Sertularians. The changes they rapidly underwent were noted and delineated; and in eleven or twelve days after " the planule had been discharged from the unwieldy Medusa, it was converted to a stationary hydra." (p. 105.) " This new animal was provided with a complement of eight arms, yet so immature as to be of unequal dimensions. Different groups, under metamorphosis, showed the utmost irregularity in respect to evolution, to their shape and proportions: nor was it until thirteen days later, or three weeks after their birth, that any appeared with eight regular tentacula. Thus was a most perplexing problem solved—the *Hydra tuba* proved to have sprung of a Medusa." (p. 105.)

The progress of discovery went on. Sir John had "remarked

colonies of minute transparent animals swimming in vessels of sea-water, during the months of February, March and April. Their general aspect very much resembled a flock of birds in distant flight, as represented by landscape painters. After being transferred to vessels free of other subjects, they continued several days in activity and then disappeared. I could not account either for their origin or their transience. They occurred only at rare intervals, and always identically under the same form." (p. 111.) These very minute beings, for the expansion of an individual is only between one and two lines, were evidently allied to the Medusæ "both in configuration and in habits," but they differed from the Medusæ in the early date of their appearance. To distinguish them Sir John called the species *Medusa bifida*, and we have it minutely described and variously figured. Sir John was first led to remark that it was chiefly observed in vessels containing the *Hydra tuba* (p. 114); and subsequently, and as it were by accident, he discovered that the hydra was in fact their source; and moreover that the hydra was identical with the *Strobila* of Sars! The discovery is told in a most interesting manner, and with a truthfulness which there is no gainsaying.

We shall quote only a few of the many passages we have marked, previously observing that the *Hydra tuba* in its strobila-form is something like a fir-cone or a cylinder cut into several whorls, each whorl, when detached, becoming what is named the *Medusa bifida*. The strobila throws off these whorls in succession to the number of from ten to twenty, when the basis, as already stated, reassumes the form and habits of the hydra.

"First, a smooth fleshy bulb sustained a cylinder of about half its own diameter, indented by plain circles, which were soon converted to waving curvatures. A row of twenty or twenty-four tentacula crowned the summit of the cylinder, which row disappeared or was obliterated as the waving in its vicinity deepened, and the diameter of the cylinder there expanded, that is, towards the summit. Concomitant on obliteration of the terminal row, a new circle of tentacula, at first few, but gradually augmenting, was emerging from around the bulb, while the struggles of Medusæ, into which the waving strata were evolving, accomplished their liberation to swim unconstrained in the surrounding element." (p. 121.)

"Certain facts admit of no dispute; such as the existence of a vigorous hydra attached to a solid substance, with long flowing silky tentacula; an alteration in the figure of the body, or the formation of an embryonic roll of Medusæ on the disc; the gradual maturity of each Medusa and its liberation from the roll; the disappearance of the original tentacula of the hydra; the emerging of a new circle of tentacula from a smooth fleshy bulb, sustaining the embryonic roll, as the former are obliterated, and as the Medusæ approach maturity; the evolution of thisfleshy bulb as a perfect hydra, along with their departure, which becomes the parent of progeny by gemmation, and its permanence as an independent animal." (p. 122–3.)

"All the Medusæ in the embryonic roll are separate and distinct animals. Each is in close application to that which is next below, if itself be uppermost, or lies between two if intermediate. The pro-

boscis is outermost if the individual be uppermost in the roll; thus all lie in the same direction, the proboscis outermost, as the Medusa escapes, from the next left behind. When the last remains in adhesion to the fleshy bulb, its proboscis projects outwards also. Thus the under surface of the embryo is always outwards, while a portion of the roll." (p. 124.)

"Although by repeated, long, and painful observation, I have endeavoured to learn the history of the *Hydra tuba* and the *Medusæ* originating from it, my purpose has been but partially attained. I have selected many individuals, and I have chosen colonies of both, to discover whatever changes they should undergo. The hydra grew, it fed, it bred, its existence was long. The Medusa lived, it neither fed nor bred, its existence was infinitely shorter; nor did it undergo the smallest change from the first moment of liberation for fifty-five days. Its life could not be protracted, on any occasion, beyond sixty days. Between the form and habits of these two animals there is not the smallest correspondence." (p. 128.)

We pass on to take a cursory notice of our author's account of the Ascidian Zoophytes.

Plates 43 and 44 illustrate *Cellularia loriculata.* "The hydra is minute, lively and active, almost transparent or dingy white; it seldom protrudes from its dwelling, which has scarcely any perceptible margin. When doing so, twelve is the usual number of tentacula displayed. Some have fourteen." (p. 234.) Farre says that the tentacula are only ten in number.

Cellularia reptans occupies plate 45. The hydra has twelve tentacula.

Cellularia fastigiata is the subject of plate 46. The hydra has sixteen or eighteen tentacula.

Cellularia ciliata forms the subject of a pretty plate, no. 47. "None of the numerous tribe of Corallines can exceed the symmetry, elegance and beauty of this interesting product waving amidst the waters. The singularity of its parts and proportions seem to have originated with the vigorous efforts of a sportive organic nature." (p. 239.)—To the vigorous enthusiasm which dictates such a passage, and there are many such in the volume, we owe the strength which supported our author in his long yet unwearied labours.—The hydra has from twelve to fourteen tentacula, and is remarkably vivacious.

Cellularia avicularis is figured in plates 48 and 49. Of the latter we know not what to say: it does not please us, and is useless as a scientific drawing, however imposing it may look to the amateur or artist. Sir John has found the species only as a parasite on the *Flustra truncata.* "A lively ascidian hydra with fourteen, fifteen, and, I believe, sometimes sixteen tentacula, inhabits the cells." (p. 242.)

The bird's-head processes or *avicularia* our author has seen on *Cellularia ciliata, fastigiata, avicularis,* and *Flustra Murrayana.* The obscurity which hangs over their function has not been lessened or removed by his researches; and the conjecture which he throws out doubtingly that they may be parasitical seems to us altogether un-

tenable. "I cannot believe," says Sir John, "that it (the *avicularium*) is connected with the hydra, from finding it seated and active on the side of those cells wherein there are none. Nevertheless, it is an integral part of the zoophyte, in so far as being generated along with new or reproducing portions. This, indeed, does not exclude the character of a parasite; for I have understood that those infesting the larger animals sometimes occur in the fœtus." (p. 245.)

Valkeria imbricata is well-figured on plate 50; *V. cuscuta* on plate 51, and on the same plate *V. spinosa* in a less satisfactory and less complete manner.

Sir John is of opinion that the genus *Serialaria* is unnecessary, and he places its only species in the genus *Valkeria*. It forms the subject of plate 52. The cells are not ranged in a straight line in single series as usually described, but "in partial alternation, the convex side of one being applied to the opposite recess formed by the union of two, somewhat like the position of two rows of cells in a honeycomb." (p. 250.) Like all *Valkeriæ*, the polype has eight tentacula.

Bowerbankia repens and *B. densa* are figured in plate 53, and the species are described in the text. But beyond furnishing us with a series of interesting figures and authentic and original descriptions, we do not find that our author has added any novelty to our knowledge of ascidian zoophytes, beyond some additions to their external anatomy and some corrections of less careful observers.

And now we bid a farewell—we trust a short one—to our author, whose book has engrossed very pleasantly some days of our leisure. We learn that his portefeuille contains many similar memoirs to those herein published, and we could wish to have the influence of hastening also their publication; but surely such influence, if possessed, is unnecessary, for in the honourable fame this volume has secured for Sir John Graham Dalyell there is enough to urge him on to the completion of his ever-during monument.

PROCEEDINGS OF LEARNED SOCIETIES.

BOTANICAL SOCIETY OF EDINBURGH.

Feb. 10, 1848.—The Rev. Dr. Fleming, President, in the Chair.

The following communication was read:—

"An Account of a Botanical Excursion to Braemar, Clova, and Ben Lawers, with his pupils, in August 1847," by Professor Balfour. Having made some general observations on the botany of the alpine districts of Scotland, Dr. Balfour proceeded to give a detailed account of the localities visited and the plants gathered. From Aberdeen the party went to Ballater, thence by Lochnagar to Castleton of Braemar, where they remained ten days, examining Ben Aven, Benna-Muich-Dhui (on the top of which they slept for a night), Cairn Toul, Breriach, Glen Callater, Clova, Glen Isla, &c. Leaving Braemar, they walked by Glen Tilt to Blair Athol, and thence by the Pass of Killiecrankie to Kenmore, Ben Lawers and Loch Lomond. All the usual, and many very rare alpine species were gathered. *Carex*

leporina was picked both on Lochnagar and on Cairn Toul; *Carex vaginata* was found on every hill in the Braemar district; *Woodsia hyperborea* was gathered in Glen Isla, Glen Phee, Clova, and on Ben Lawers; *Luzula arcuata* was seen on all the lofty summits in the vicinity of Ben-na-Muich-Dhui; *Mulgedium alpinum* was detected in considerable quantity on Lochnagar; also a beautiful variety of *Hieracium alpinum* with remarkably long leaves and involucres covered with long white silky hairs: it is *H. alpinum* var. *longifolium* of 'Flora Silesia.' In the vicinity of Ballater, and also in Glen Tilt, *Equisetum umbrosum* grew in profusion. The sides of Loch Etichan and the rocks near Loch Aven were covered with numerous alpine varieties of *Hieracia*, presenting remarkable transition forms: among them were *H. alpinum, Halleri, nigrescens, Lawsoni,* &c. *Orobus niger* was gathered at the Pass of Killiecrankie.

Dr. Balfour then made some remarks on the progress of vegetation in the vicinity of Edinburgh and the injury done by the late frost, in the course of which he stated that *Galanthus nivalis* was in flower in the Botanic Garden, and *Eranthis hyemalis* in Dr. Neill's garden on the 10th inst.

MISCELLANEOUS.

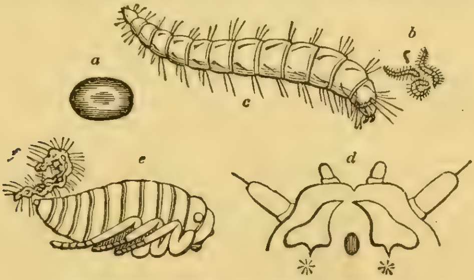
THE COMMON FLEA (PULEX IRRITANS).

Everybody knows that common domestic insect, the flea; but it is not everybody who knows that it undergoes a series of changes as singular as those of the butterfly or beetle; being first a minute egg, then a long slender worm-like larva, then an inactive pupa inclosed within a cocoon spun by the larva; and lastly, the perfect flea itself. My object in this article is to describe these transformations, and to add a practical suggestion for the easy destruction of these little pests.

During the course of the past summer, having dropped a very minute insect on the floor of my library, close to the spot where one of my spaniels is in the habit of lying near my feet, I was obliged, in order to find it, to sweep the carpet very carefully with a fine brush upon a piece of white paper. By doing this I found my specimen; but I also discovered a number of very small, white, worm-like larvæ, which I immediately recognised as those of the common flea. I was not sorry to make this discovery, being anxious to examine the structure of this larva, and especially that of the parts of its mouth (hitherto undescribed), in consequence of the interesting position which the perfect insect occupies in the classification of hexapod insects, forming, as it does, a separate order, to which the name of Aphaniptera has been applied, from no wings being visible upon the insect, although their representatives exist in the shape of two flattened scales on the sides of the body attached to the proper wing-bearing segment.

The female flea deposits about a dozen white, slimy eggs of an oval form (fig. *a*, one of the eggs very highly magnified), and which are of a rather large size in proportion to that of the parent insect. The larvæ are hatched in summer at the end of five or six days. They are at first white, but subsequently assume a slight reddish tinge,

with a dark, longitudinal streak down the back, which is the dorsal vessel. They are long and slender (fig. *b* represents a group of four of them of the natural size, and fig. *c* one of them highly magnified). The body consists of thirteen segments, gradually but slightly tapering towards the head, the segments being armed at the sides with strong bristles. They are destitute of legs, but are nevertheless able to crawl along with great rapidity, using the parts of the mouth and the appendages at the end of the body in locomotion. When disturbed they writhe about in a serpentine direction, or coil themselves up spirally remaining for a short time immoveable, and thus easily escape observation. The head is small and conical, furnished with two short antennæ composed apparently of two joints, the basal one being very short, and the outer one terminated by a bristle (fig. *d* represents the front of the head seen from above, very highly magnified); the mouth is furnished with two large brown horny jaws, pointed in a slight hook at the tips (fig. *d***), and the lower part of the mouth seems to consist of a large fleshy somewhat bilobed lip, furnished with two very minute two-jointed palpi. I also observed a small semi-globular tubercle on each side of the head behind the antennæ, which may be the rudimental eyes. The terminal segment of the body is furnished with two small deflexed hooks, preceded by a coronet of minute setæ, and which are evidently employed in walking.



When full-grown these larvæ assume the pupa state, having first entirely voided the remains of their undigested food, as is the custom with other larvæ. All the larvæ which I kept encased themselves within a cocoon of a silky texture and of an ellipsoid form, of a whitish colour within and grayish externally, often covered with minute particles of the adjacent materials. Rösel, however, observed that some of the larvæ underwent these changes without forming a cocoon. The pupa inclosed within the cocoon bears considerable resemblance to the perfect insect, with this difference, that the legs are folded close on the sides of the body, and the insect is inclosed within a thin pellicle, each of the limbs being covered by a distinct case; of course during this period the insect remains quite inactive, but as soon as the period for its final transformation arrives, it stretches forth its limbs, and casts off the thin pellicle with which it had been covered, and then appears as a perfect flea. Figure *e* represents the pupa highly magnified, with the cast skin of the larva (fig. *f*) attached to the extremity of its body.

One curious question still remains to be decided in the natural history of this insect, namely, the nature of the food of the larva. Although the perfect insect is generally found on warm-blooded animals and man, there is no question that it is capable of breeding to a vast extent in places not frequented by such animals. Rooms left for a long time vacant, and some hot sandy localities, may be found occasionally swarming with fleas. At all events the larvæ are never found on the animals attacked by the perfect insects. M. De France, who endeavoured to determine the question, found numerous small black grains in company with the eggs or larvæ of the flea, and which he asserts become the food of the larvæ, being nothing else than dried drops of congealed blood, which, upon being moistened, immediately re-assume a fluid state and red colour. These grains have been generally regarded as the excrement of the perfect fleas, but M. De France considers them to be in fact drops of blood which have fallen from the wounds made by the flea. My own opinion, now that the remarkably powerful structure of the jaws of the mouth has been discovered, is rather that the larvæ roam about and feed upon hairs or particles of woollen or feathers lying on the spots frequented by the animals attacked by the perfect flea.

The knowledge of these facts in the œconomy of this insect suggests that by carefully sweeping carpets, mats, &c., on which dogs or cats are in the habit of lying, and by collecting the sweepings in a dust-pan and burning them (instead of allowing the larvæ to creep away into cracks of the floor or even in the hollows between the threads of the carpet), we may destroy the larvæ in great numbers, and thus prevent them from arriving at their perfect troublesome form. —J. O. W. *in the Gardeners' Chronicle for March* 4.

Instance of a singular Anomaly in the History of the Honey Bee. By George Darling, Esq.

Mons. Huber, in his wonderful and accurate researches into the history of the Honey Bee, discovered that, if a young queen passes the twenty-first day without intercourse with the drone, she will be only partially fertile, laying nothing but the eggs of drone brood; nor does she lay these eggs in the appropriate comb, but in the comb proper for workers. This curious fact I have seen proved several times; but one not noticed by the careful Frenchman came under my observation this summer. I had placed a young queen in a small experimental hive; she was very soon impregnated, and filled a sheet of comb with eggs. I removed her to another hive, and, in the usual time, the bees turned out several young brood for queens to make up for her loss. One of these, at the proper time, emerged from the cell, and destroyed the others. Three days after hatching she began to lay eggs, and as I supposed all right, but about a week after, when I examined the hive, I found the queen thrown out, and three cells converted into royal ones; but to my surprise, I found that all the grubs were drones, both those in the forced royal cells, and those through the combs; and I have no doubt that the bees had, on finding their queen imperfect in her functions, killed and thrown her out; but here their instinct had not been sufficient to teach them that a

drone grub could not be converted into a queen, for they sealed up the grubs and waited patiently the time for their hatching. The young drones never hatched, but shrivelled in the cells, which would lead to the conclusion that the food suitable for a young queen is not adapted to bring a drone to perfection.—*From the Transactions of the Berwickshire Naturalists' Club*, vol. ii. p. 205.

METEOROLOGICAL OBSERVATIONS FOR FEB. 1848.

Chiswick.—February 1, 2. Clear and fine. 3. Cloudy. 4. Overcast: rain. 5. Densely overcast: heavy rain at night. 6. Overcast and mild. 7. Densely overcast: rain. 8. Cloudy and fine. 9. Cloudy: boisterous: clear. 10. Very fine: heavy rain at night. 11, 12. Very fine. 13. Overcast. 14. Rain. 15. Densely overcast: rain. 16. Frosty: clear and fine. 17. Clear: cloudy and fine. 18. Fine. 19. Rain: hazy and damp. 20. Foggy: cloudy: clear. 21. Overcast: rain. 22. Rain. 23. Heavy clouds: fine. 24. Densely overcast: rain. 25. Rain: showery. 26. Barometer most remarkably low: boisterous, with heavy rain. 27. Heavy rain: clear and boisterous at night. 28. Fine: clear. 29. Very clear: boisterous, with rain at night.

Mean temperature of the month .... 39°·62
Mean temperature of Feb. 1847 .... 34 ·79
Mean temperature of Feb. for the last twenty years .... 39 ·32
Average amount of rain in Feb. .... 1·95 inch.

Boston.—Feb. 1, 2. Fine. 3. Cloudy. 4. Rain. 5. Cloudy: rain P.M. 6. Rain. 7. Cloudy. 8. Cloudy: rain P.M. 9. Cloudy: rain early A.M.: rain A.M. 10—13. Fine. 14. Rain: rain P.M. 15. Cloudy: rain early A.M. 16—18. Fine. 19. Cloudy: snow early A.M. 20. Rain. 21. Fine: rain P.M. 22. Cloudy: rain P.M. 23. Fine: rain P.M. 24. Cloudy: rain P.M. 25. Fine. 26. Fine: rain early A.M. 27. Cloudy: rain early A.M.: rain A.M. 28. Cloudy. 29. Fine.

Applegarth Manse, Dumfries-shire.—Feb. 1. Hard frost A.M.: thaw and rain P.M. 2. Thaw: threatening frost again. 3. Thaw: rain: high wind. 4. Heavy rain: snow gone. 5. Heavy rain: floods. 6. Moist A.M.: showery P.M. 7. Thick fog ending in rain. 8. Heavy rain all day. 9. Rain A.M.: cleared: rain P.M. 10. Slight showers. 11. Very fine spring day. 12. Dull morning: wet P.M. 13. Heavy rain and high winds. 14. Fair, but threatening change. 15. Rain all day. 16. Frost: a shower of snow. 17. Hard frost: hills white: snow. 18. Hard frost: rain P.M. 19. Showery. 20. Beautiful day: slight frost A.M. 21. Raw frost A.M.: moist. 22. Storm of rain and wind: flood. 23. Stormy day: violent showers. 24. Snow for two hours: heavy rain. 25. Fair and milder. 26. Fair A.M.: drizzle P.M. 27. Heavy rain all day. 28. Heavy rain: thunder. 29. Showers: hail.

Mean temperature of the month .... 40°·1
Mean temperature of Feb. 1847 .... 36 ·2
Mean temperature of Feb. for twenty-five years .... 37 ·3
Rain .... 5·53 inches.
Mean rain in Feb. for twenty years .... 2·04 ,,

Sandwick Manse, Orkney.—Feb. 1. Snow-showers: cloudy. 2. Frost: clear. 3. Cloudy: showers. 4. Rain: damp. 5. Snow-drift: snow. 6. Snow: cloudy. 7. Rain. 8. Bright: showers. 9. Cloudy: damp. 10. Rain: cloudy. 11. Bright: cloudy. 12. Rain: showers. 13. Showers. 14. Showers: clear. 15. Damp: rain. 16, 17. Bright: frost. 18. Sleet: rain. 19. Sleet-showers: showers. 20. Bright: snow-showers. 21. Snow: red aurora. 22, 23. Cloudy: rain: aurora. 24. Bright: frost: fine: aurora. 25. Showers. 26. Cloudy: showers. 27. Showers: rain. 28. Damp: rain. 29. Clear: cloudy.

The following are the averages for Dec. 1847, with which we have been favoured by our correspondent the Rev. Ch. Clouston of Sandwick Manse, whose usual report miscarried owing to the stormy weather which then prevailed:—

Barometer.		Thermometer.		Rain in inches.
A.M.	P.M.	A.M.	P.M.	
29·597	29·595	39·93	40·66	5·24

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1848. Feb.	Max.	Min.	8¼ a.m.	9 a.m.	9 p.m.	9¼ a.m.	8½ p.m.	Max.	Min.	8¼ a.m.	Max.	Min.	9¼ a.m.	8½ p.m.								
1.	30·071	29·763	29·45	29·60	29·70	29·53	29·70	37	26	29·5	36½	09½	31	31	nw.	nw.	ne.sw.	n.	......	......	......	......
2.	30·315	30·153	29·76	29·88	29·97	29·90	29·67	46	29	38	41½	34½	29	41½	w.	n.	ene.	sw.	......	......	......	·28
3.	30·363	30·241	29·94	29·90	29·75	29·55	29·39	46	33	37	43	35½	43	48	sw.	wsw.	s.	sw.	·01	......	......	·05
4.	30·167	30·111	29·73	29·66	29·63	29·36	29·69	51	39	40	47	42	47	40	sw.	sw.	sw.	n.	·03	......	......	·65
● 5.	30·100	30·059	29·65	29·69	29·70	29·92	30·06	53	48	53	52	45	32	32½	sw.	calm	sw.	e.	·23	·04	......	·08
6.	30·139	30·075	29·63	29·94	29·94	30·20	30·13	55	46	51·5	49½	37½	35	35	w.	calm	ene.	ese.	·01	·18	......	......
7.	29·997	29·818	29·54	29·70	29·61	29·75	29·60	52	40	46	46	38	36½	44	sw.	ssw.	ssw.	wsw.	·25	·06	......	·40
8.	29·859	29·694	29·44	29·59	29·20	29·53	29·12	52	44	43	47	36	41½	41	sw.	calm	s.	se.	·26	......	1·50	·26
9.	29·096	29·027	28·62	28·64	28·56	28·88	28·77	51	36	49	48	43½	41	40	sw.	calm	sw.	ne.	·01	·64	......	·06
10.	28·986	28·840	28·57	28·55	28·59	28·48	28·67	49	37	40	43½	38½	40½	38	sw.	calm	sw.	n.	·52	·03	......	·18
☽ 11.	29·548	28·984	28·72	28·96	29·38	29·01	29·32	47	30	32	48	34½	43	35½	nw.	calm	w.	wnw.	......	......	......	......
12.	29·946	29·892	29·50	29·51	29·50	29·17	29·00	48	36	36	47	34½	40	43	w.	calm	sw.	w.	......	......	......	·15
13.	30·051	29·936	29·56	29·51	29·35	29·12	29·07	51	47	47·5	51	38½	42	43	sw.	calm	sw.	sw.	......	......	......	·27
14.	29·863	29·658	29·40	29·44	29·44	29·12	29·46	53	48	52	50½	43	42½	36½	sw.	w.	sw.	e.	·04	......	......	·18
15.	29·544	29·174	29·10	29·33	29·30	29·43	29·45	49	26	45	43	39½	40	38½	s.	calm	sw.	ne.	·03	·52	......	·11
16.	29·956	29·713	29·40	29·59	29·95	29·80	30·11	44	25	35	40½	32	40½	35	n.	calm	wnw.	n.	......	......	0·63	·42
17.	30·436	30·244	29·91	30·24	30·31	30·31	30·26	45	29	35	41	28½	35	34½	ne.	calm	se.	s.	......	......	......	......
18.	30·420	30·182	30·08	30·15	29·64	29·84	29·34	42	25	32·5	40½	26	39	42	s.	calm	e.-sw.	ssw.	·16	......	......	......
○ 19.	29·778	29·553	29·45	29·46	29·28	29·20	29·27	49	32	37	46½	38½	42½	37	w.	sw.	wsw.	w.	·02	......	......	·25
20.	29·744	29·364	29·05	29·30	29·56	29·50	29·42	48	25	40	46	33½	35	37	nw.	calm	w.	w.	·02	......	......	·24
21.	29·790	29·595	29·38	29·49	29·42	29·43	29·51	46	39	36	42	33	30	29½	sw.	w.	w.	calm	·11	·43	......	·19
22.	29·478	29·142	29·10	29·02	28·64	28·87	28·47	51	39	41	48½	33½	37	36½	sw.	w.	sw.	sse.	·08	·09	......	......
23.	29·341	29·002	28·58	28·58	28·96	28·46	28·74	55	41	45	47	38	40½	34½	sw.	w.	w.	w.	......	·17	1·67	·75
24.	29·323	29·172	28·90	29·97	28·74	29·03	29·03	53	44	45	40½	35½	37½	35	sw.	calm	e.	e.	·14	·05	......	·17
25.	30·050	30·031	28·64	28·60	28·73	28·79	28·92	54	43	48	49½	35½	37½	36	sw.	w.	nw.	e.	·16	·09	......	·15
26.	29·209	28·452	28·35	28·62	28·97	28·96	29·07	51	39	46·5	47½	39	40	38	w.	calm	ne.	e.	·48	·17	......	·03
☾ 27.	29·103	28·795	28·54	28·59	28·34	28·82	28·51	55	42	46	46	35½	40½	39	sw.	s.	e.–sw	e.	·22	·10	......	·12
28.	29·419	29·244	28·82	28·80	28·94	28·60	28·72	56	35	47	49	35	42	43	sw.	w.	wsw.	wsw.	·01	·08	......	·32
29.	29·462	28·839	29·00	28·92	28·79	28·90	28·75	49	37	42	46	37½	42	40	s.	w.	w-sw.	w.	·23	......	1·73	·26
Mean.	29·777	29·550	29·23	29·352	29·341	29·291	29·283	42·69	36·55	41·9	45·6	35·5	38·72	38·08					3·02	2·65	5·53	5·57

THE ANNALS

AND

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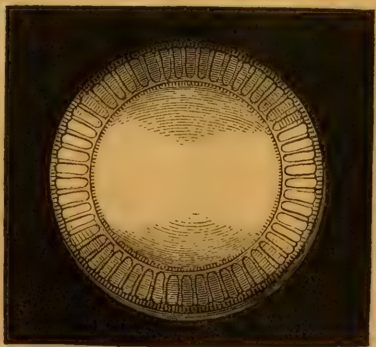
[SECOND SERIES.]

No. 5. MAY 1848.

XXXII.—*On a new British species of* Campylodiscus. By W. C. Williamson.

Whilst examining some sand dredged up by George Barlee, Esq. from a depth of sixty fathoms, off the coast of Skye, I was fortunate enough to meet with a remarkably fine species of *Campylodiscus,* which does not appear to have been hitherto described.

It presents a nearly orbicular disc, which, though slightly saddle-shaped, is considerably less curved than the Bohemian *C. clypeus,* and still less so than the *C. zonalis* of Mr. J. Phillips. The centre of the disc is perfectly smooth; but around this is a circle of short, elegant projecting radii, which extend nearly to the periphery, and give to the whole the general aspect of the face of a clock or watch; the radii representing the figures marking the hours. Within this ring, and closely bordering the inner extremities of the rays, is a circle of very minute and slightly elongated tubercles, like those which surround the central siliceous umbo of the *Arachnoidiscus Japonicus,* but much smaller. There are usually four or five of these to each interspace separating the rays. A similar circle, but with the tubercles rather more conspicuous and elongated, connects the outer extremities of the rays with the extreme margin of the disc. On the two elevated portions of the inflected disc, the rays appear to be rather stronger than else-



where, especially towards their outer extremities. It is the $\frac{1}{145}$th of an inch in diameter.

My specimen consists of at least three layers inclosing two inner cavities, which contain a green endochrome. In this it resembles many other allied forms. From what has appeared to be a single disc of *Arachnoidiscus Japonicus,* I have separated as many as six siliceous layers.

This separation into laminæ, marking the existence of so many individual frustules, reminds us of *Meloseira* and its allies ;—a resemblance that becomes the more striking, when we remember that as in *Meloseira,* the first frustules of *Arachnoidiscus, Cocconeis* and many others are attached, as parasites, to some other body. In the analytical table of the *Bacillariæ* originally given by Ehrenberg he includes many of these objects; classing *Cocconeis, Actinocyclus,* and what he calls *Bacillaria,* together in his group of *Naviculaceæ,* and characterizing them as "free," in contradistinction to his "fixed" forms, in which latter he includes *Isthmia* and other genera. It appears evident, however, that *Cocconeis* and *Arachnoidiscus* are as "fixed" when found *in situ* as any of the *Diatomaceæ,* and probably many of these other allied genera will eventually be found to exhibit the same feature when better known. I have elsewhere* endeavoured to show the close relationship which exists between these discs and the already recognized *Diatomaceæ,* and I cannot but think that by the time my enthusiastic friend Mr. Ralfs resumes his valuable labours upon the British species of this interesting group, he will find it necessary to include in his classification a large portion of our native species of what are commonly called "Siliceous Infusoria."

I would propose for the above species of *Campylodiscus* the name of *C. horologium.*

Manchester, March 23, 1848.

XXXIII.—*Notes of* Diatomaceæ *found in the stomachs of certain Mollusca.* By George Dickie, M.D., Lecturer on Botany in the University and King's College of Aberdeen†.

Professor E. Forbes has remarked that the stomachs of fishes are often zoological treasuries. The Haddock is a great conchologist; the Cod is more devoted to the Echinodermata, having a great taste for that tribe.

Certain Mollusca are equally indefatigable collectors of *Diatomaceæ*; they have been found in the stomachs of the Oyster,

* Memoirs of the Manchester Literary and Philosophical Society, vol. viii. p. 48 *et seq.*

† Read before the Botanical Society of Edinburgh, March 9, 1848.

Clam, &c.; and Dr. Hooker in the 'Botany of the Antarctic Voyage' states, that the stomachs of *Salpæ* and other (especially of the naked) Mollusca invariably contain *Diatomaceæ*, sometimes several species. These *Salpæ* were washed up in masses on the pack ice, and in decay they left the snow covered with animal matter impregnated as it were with *Diatomaceæ*. He found that the contents of the stomach of every *Salpa*, between the latitudes of the North Tropic and 80° South, invariably contained the remains of these minute plants. *Dictyocha aculeata* was universally observed in the stomachs of those found off Victoria Barrier. Mr. Lee has found them abundant in the stomach of the common Barnacle.

The following notes of species detected in the stomachs of different species of *Ascidia* and of the freshwater Mussel (*Mya margaritifera*, L.) may be worthy of record. They do not appear to have the same discrimination as to their prey which the fishes would seem to exercise, every object, whatever be its nature, coming within the sphere of the currents produced by the cilia, is swallowed, provided its size be not too great. The *Ascidia* examined were from depths varying from twenty-five to thirty fathoms, and five to six miles from land.

A time was when there would have been some hesitation in offering to the Society such a communication as the present, owing to the conviction that some of the organisms to which it has reference really belonged to the animal kingdom. The very important discovery made by Mr. Thwaites, that they present examples of conjugation like *Zygnema*, &c., leaves their true nature no longer a doubtful question. There may still be some dispute respecting the position occupied by such forms as *Coscinodiscus*, *Actinoptychus*, &c.; but if it be admitted, and there seems no reason for hesitation, that such genera as *Meloseira* and its allies are true plants, it will not be difficult to understand also the nature of those just mentioned, the transition from the one to the other being obvious.

Diatomaceæ found in the stomachs of different species of *Ascidia*:—

Eunotieæ.

Epithemia Sorex, *Kg.*?

Fragilarieæ.

Fragilaria pectinalis, *Ehr.*
Diatoma flocculosum, *Ag.*

Meloseireæ.

Meloseira sulcata, *Kg.*
M. Jurgensii, *Ag.*?

Surirelleæ.

Surirella?
Synedra lævis, *Ehr.*

Cocconoideæ.

Cocconeis Pediculus, *Ehr.*
Doryphora amphiceros, *Kg.*

Achnantheæ.

Achnanthes longipes, *Ag.*

Cymbelleæ.

Cymbella maculata, *Kg.*

Gomphonemeæ.

Gomphonema pohliæforme, *Kg.*

Naviculeæ.
Navicula Hippocampus, *Ehr.*
Ceratoneis Closterium, *Ehr.*

Coscinodisceæ.
Coscinodiscus Patina, *Ehr.*
C. lineatus, *Ehr.*
Coscinodiscus eccentricus, *Ehr.*
Actinocyclus undulatus, *Bailey.*
Actinoptychus senarius, *Ehr.*

Actinisceæ.
Dictyocha gracilis, *Kg.*

This list will afford some idea of the nature of the deposits going on in the Aberdeen bay at the depth and distance from land already mentioned.

The following species were evidently in a living state:—*Melosiera sulcata, M. Jurgensii, Synedra lævis, Navicula Hippocampus, Surirella ?, Coscinodiscus Patina, Actinoptychus senarius,* and they were also very common; in this latter respect, however, they were not superior to the *Dictyocha* and *Doryphora.*

Of those enumerated, the following are usually met with in fresh water: *Fragilaria pectinalis, Diatoma flocculosum, Cocconeis Pediculus, Cymbella maculata* and *Gomphonema pohliæforme*; they were also much less abundant than the others. Their presence is readily accounted for, when it is considered that two large rivers, the Dee and Don, besides numerous smaller streams, empty themselves into the bay. Mr. Thwaites informs me that he has found the *Meloseira sulcata* both in fresh and brackish water. Some of the species mentioned are not uncommon in the mud of our harbour.

Mixed up with the *Diatomaceæ* were numerous individuals belonging to two or three forms of Foraminifera, also spiculæ of a species of *Grantia* and fragments of *Ulvæ,* with particles of silex in a finely divided state.

Some of those enumerated have a very extensive distribution: *Meloseira sulcata* has been found at Melville Island, and by Dr. Hooker at Victoria Barrier, where *Coscinodiscus eccentricus* and *C. lineatus* also occur. These and others are abundant in guano from Africa and Peru, and are now in myriads mixed with the soil of our fields, and their presence may perhaps at a future time be a puzzle to some assiduous Philomikros who may be ignorant of the history of British agriculture.

Although temperature may exercise little influence over the distribution of *Diatomaceæ,* it may not be irrelevant to record here that of the sea in the Aberdeen bay, as ascertained by Mr. James Stratton, whose observations were made occasionally from March 1845 to September 1846 inclusive. The mean temperature at a mean depth of 24·5 fathoms, four miles from land, is 47°·7 F., being nearly one degree higher than that of the air as observed in the vicinity of Aberdeen. The minimum took place in March, being 39°·5 F., exactly the mean temperature of the ocean according to Sir J. C. Ross.

The freshwater Mussel (*Mya margaritifera*, L.) is abundant in both the Dee and Don. The specimens in whose intestines the following *Diatomaceæ* occurred, were from the former river eighteen miles inland.

Meridieæ.

Meridion circulare, *Ag.*

Fragilarieæ.

Fragilaria hyemalis, *Lyngb.*
Diatoma flocculosum, *Ag.*
D. tenue, *Ag.*

Meloseireæ.

Meloseira distans, *Kütz.* ?

Surirelleæ.

Synedra capitata, *Ehr.*
S. tenuis, *Kütz.*

Cocconoideæ.

Cocconeis Pediculus, *Ehr.*

Achnantheæ.

Achnanthes minutissima, *Ehr.*

Cymbelleæ.

Cymbella flexella, *Kütz.*
C. leptoceras, *Kütz.* ?
Cocconema cymbiforme, *Ehr.*

Gomphonemeæ.

Gomphonema geminatum, *Ag.*
G. pohliæforme, *Kütz.*
G. minutum, *Ag.*

Naviculeæ.

Navicula rhomboides, *Ehr.* ?
N. cuspidata, *Kütz.*
N. viridis, *Kütz.*

Intermixed with these were spiculæ of *Spongilla*. Generally speaking the individuals of each species were of the minimum size, certainly far less than that usually attained. Of those brought within the sphere of the currents produced by the cilia, the smaller alone were swallowed. Of the species enumerated I have found the following on our mountains at heights varying from 2800 to 3800 feet: viz. *Meridion circulare, Diatoma flocculosum, D. tenue, Meloseira distans* ?, *Gomphonema pohliæforme, G. minutum, Navicula rhomboides* ? and *N. viridis*. The *Meloseira* I have found to constitute a considerable proportion of the fine black mud found beneath patches of snow on Ben-na-Muich Dhu.

XXXIV.—*Notice of a new species of* Spiridens. By R. K. Greville, LL.D. &c.*

[With a Plate.]

The genus *Spiridens*, established by Nees von Esenbeck in the 11th volume of the 'Nova Acta Acad. Cæs. Leopold. Car. Naturæ Curiosorum,' has hitherto contained the single species it was constituted to receive, viz. *Spiridens Reinwardtii*. This most noble of all mosses, as it is justly designated by Sir W. J. Hooker, is a native of the Molucca Isles; twelve inches or more in height, with a robust, Bartramia-like habit. It is figured in the Transactions above-mentioned; but the British botanist will also find a figure and description in the first volume of Sir W. J. Hooker's 'Botanical Miscellany,' published in 1830.

* Read before the Botanical Society of Edinburgh, March 9, 1848.

In looking over a small collection of Cryptogamous plants recently gathered in the island of Tahiti by Dr. Sibbald and sent by him to Professor Balfour, I found two specimens (only two, alas!) of a moss which a single glance convinced me must belong to the genus *Spiridens*; and the capsules being in a perfect state enabled me to determine this at once in the most satisfactory manner. The resemblance which it bears in general character to *S. Reinwardtii* is so marked, that at first it seemed doubtful whether it might not be a mere variety, but a more careful inspection rendered the specific distinctions quite apparent. The new species is a smaller and more slender plant, six to nine inches long or more, the leaves scarcely more than half the size, the capsules more cylindrical and the subulate termination of the operculum considerably longer and finer. It is under the microscope, however, that the most characteristic features are perceived to exist in the leaves; the margin of which in *S. Reinwardtii* is distinguished by a broad flat border closely and sharply toothed; in the new species by a very narrow thickened border remotely toothed. Without entering into a minute description, uncalled for in so brief a notice, the following specific characters may be assigned to the two mosses:—

S. Reinwardtii (Nees); foliis late marginatis, acute dentatis; dentibus approximatis; capsulis ovato-oblongis.

S. Balfouriana (nob.); foliis anguste marginatis, remote dentatis; capsulis ovato-cylindraceis.

This beautiful species of one of the finest genera in the family I have sincere pleasure in naming after my highly esteemed friend Dr. Balfour, Professor of Botany in the University of Edinburgh.

EXPLANATION OF PLATE XVII.

Fig. 1. *S. Balfouriana*, nat. size.
Fig. 2. Leaf.
Fig. 3. Margin of the leaf of *S. Reinwardtii.*
Fig. 4. Ditto of that of *S. Balfouriana.*
Fig. 5. Perichætial leaves and capsule.
Fig. 6. Peristome.—Figs. 2–6 all magnified.

XXXV.—*Notice of two new species of Ferns belonging to the genera* Oleandra *and* Polypodium. By R. K. Greville, LL.D. &c.*

[With a Plate.]

The genus *Oleandra* of Cavanilles, adopted by Presl and now generally received for a section of the old genus *Aspidium*, is one

* Read before the Botanical Society of Edinburgh, March 9, 1848.

of the most natural in habit of the family of Ferns, and not less beautiful than well-defined. It is at the same time so limited in extent that the addition of a new species becomes a subject of considerable interest. The recorded species are *Oleandra nodosa* (*Aspidium nodosum*, Willd.), native of the islands of the West Indies; *O. articulata* (*Aspidium articulatum*, Sw.), found in the Mauritius; *O. neriiformis* (*Aspidium neriiforme*, Sw.), growing in the Philippine Islands and the East Indies; *O. Wallichii* (*Aspidium Wallichii*, Hook.), confined to Nepal; and *O. pilosa*, Hook., brought by Sir Robert Schomburgk from British Guiana. The last-named species, which is figured by the author in his beautiful 'Genera Filicum,' tab. 45, is most allied to the fern I have now the pleasure of laying before the Botanical Society. The latter was recently communicated to Professor Balfour from Tahiti, where it was collected by Dr. Sibbald, a gentleman, who, under all the disadvantages arising from the confusion which existed in that unhappy island, during the time of his visit, made some botanical discoveries of great interest; and I feel no small satisfaction in dedicating to him this very fine fern.

The character of the Hookerian species with which it has to be contrasted is as follows:—

O. pilosa (Hook.); stipite ad basin articulato, fronde subtus pubescenti-hirsuta, indusiis longe ciliatis.—*Hook. l. c.*

Dr. Sibbald's fern may be thus defined:—

O. Sibbaldii (nob.); stipite ad medium articulato, fronde utrinque pubescenti-hirsuta, indusiis integerrimis.

The frond is about eighteen inches long, membranaceous, linear-lanceolate like all its congeners, but more or less gradually attenuated below, and in this respect differing much from *O. pilosa*; both surfaces are pubescent, the margin especially, fringed with hairs; beneath, the midrib is set with long chaffy scales. The arrangement of the sori, although not so regular as in *O. neriiformis*, is much more so than in *O. pilosa*, forming a more or less undulating line on each side, at from two to four lines distance from the midrib. I could have wished that the indusium had been in a younger state, nevertheless the organ is quite entire, and there is not the slightest trace of ciliation.

Another fern in the same collection, discovered in Raiatea, of which there exists only one specimen, appears like the former to be undescribed, and to possess considerable interest from its ambiguous appearance. With a general form of frond bearing a close resemblance to *Blechnum Spicant*, it has the sori of a *Grammitis*; and totally unlike as it is in habit to any *Grammitis*

with which I am acquainted, I do not see how it can be placed in any other genus.

Grammitis blechnoides (nob.); fronde coriacea, utrinque attenuata, profunde pinnatifida, soris lineari-oblongis, subobliquis, numerosis.

Fronds numerous, from a creeping rhizoma which is densely covered with pale reddish brown scales, lanceolate, coriaceous, glabrous, seven to nine inches high, attenuated at each extremity, pinnatifid almost if not quite to the rachis, the segments alternate, entire, linear, obtuse, about half an inch long in the widest part of the frond, diminishing gradually in size below until they disappear a few lines from the rhizoma. Veins simple, internal. Sori oblong or linear-oblong, slightly oblique, arranged in a line on each side between the midrib and the margin, somewhat sunk in the thick substance of the frond.

EXPLANATION OF PLATE XVIII.

Fig. 1. *Grammitis blechnoides*, natural size.
Fig. 2. One of the segments, a portion of its substance removed to show the venation.
Fig. 3. Sori.
Fig. 4. Capsules.
Fig. 5. Seeds.—Figs. 2–5 magnified.

XXXVI.—*Descriptions of* Aphides. By Francis Walker, F.L.S.

[Continued from p. 260.]

Fourth Group.

The chief peculiarity of the only species in this group is the abundance of cottony filaments which emanate from its body, and it resembles the preceding *Aphis* in the shortness of its nectaries and of the seventh joint of its feelers.

6. *Aphis Fagi*, Linn.

Aphis Fagi, Linn. Syst. Nat. ii. 735. 23; Faun. Suec. 994; Geoff. Ins. i. 497. 12; Réaum. Ins. iii. t. 26. f. 1; Fabr. Ent. Syst. iv. 214. 24; Syst. Rhyn. 297. 24; Burm. Handb. der Ent. ii. 92. 2.

Lachnus Fagi, Kalt. Mon. Pflan. i. 147. 1.

The viviparous wingless female. This appears on *Fagus sylvatica*, the beech, before the end of April; as soon as it is hatched from the egg it resorts to the veins of the young leaves, and is then pale green or yellow, very small, long, narrow, slightly convex, nearly linear, or somewhat increasing in breadth towards the tip of the abdomen; its sides are covered with white filaments: the feelers are filiform or slightly setaceous, dark green, paler at

the base than towards the tips, and hardly more than one-fourth of the length of the body; the fourth joint is more than half the length of the third; the fifth is a little shorter than the fourth; the sixth is shorter than the fifth, and the seventh than the sixth: the eyes are brown: the mouth is pale green with a brown tip: the back is adorned with rows of black spots which become more distinct towards the head: the nectaries do not rise above the surface of the abdomen: the legs are dull pale green, and rather short; the knees and the feet are darker. It sheds its skin in May, and is then paler, but as it grows it acquires a more vivid green colour, and has occasionally three rows of black spots along its back; it now exudes more abundantly the white cottony matter wherein it soon becomes fully wrapped; this secretion abounds beneath the leaves, and being removed thence it changes into a solid sugar or gum sweet to the taste and melting on the tongue. When full-grown it is oval and flat, and has six rows of darker spots along the back; these spots are all confluent with the exception of the outer row on each side: the forehead is convex, and without spines: the feelers are rather less than half the length of the body; the fourth joint is much shorter than the third; the fifth is a little shorter than the fourth, and the sixth than the fifth; the seventh is extremely short: the mouth extends to the middle of the space between the fore-hips and the middle hips. The body varies in shape; sometimes it is long and narrow, sometimes it is comparatively short and broad.

The viviparous winged female. The rudimentary wings are pale yellow, and they are unfolded in the middle of May: the body is then pale green, thickly clothed with white filaments: the disc of the head and that of the chest are black, and the abdomen has a black band across each segment, and a row of black spots on each side: the feelers are black, slightly setaceous, and rather more than half the length of the body: the mouth is pale green; its tip, the eyes, and the legs are black; the latter are moderately long; the fore-thighs are pale green: the wings are colourless; the wing-ribs are pale green; the wing-brands and the veins are brown. It looks like a twist of cotton floating through the air, and its down has sometimes a delicate and beautiful azure hue.

Length of the body $1\frac{1}{4}$ line; of the wings $2\frac{1}{2}$ lines.

The oviparous wingless female. This appears in October, and is shining pale yellow or pale orange, which latter colour it may owe to the eggs which it incloses: it has also sometimes a reddish tinge on each side which is adorned with a row of black dots, and frequently there is also a row of short black or gray bands along the back of the abdomen. The eggs are fastened in November to the twigs of the beech-tree; when newly laid they are yellow, but they soon become black.

The winged male. It pairs with the wingless female at the end of October: it is slender, dull pale greenish yellow, and thickly covered with gray powder: the head, the disc of the chest, and that of the breast are dark gray, and the abdomen has a row of dots on each side and one of short bands along its back of the same colour: the feelers are black, dull yellow at the base, and a little longer than the body: the mouth and the legs are pale yellow; the former has a black tip; the knees, the feet, and the tips of the shanks are black; the hind-legs are dark gray: the wing-ribs are pale yellow, and the wing-brands are pale brown.

I have counted above twenty young ones of various size in one wingless female, which form, with its winged descendant, abounds from the middle of May till the middle of June. During the following months the species disappears from the beech-leaves with the exception of a very few little Aphides whose growth seems to be retarded. The second epoch of *A. Fagi* is October, the only season for the assemblage of all its forms, when the viviparous and oviparous females and the males swarm together, and this remark will apply to most other species of *Aphis*.

Fifth Group.

7. *Aphis antennata*, Kaltenbach, Mon. Pflan. i. 115. 88.

The viviparous winged female. The body is stout and thick, and of a bright grass-green colour: the head is broad: the front has a small spine in the middle, and a short spine on each side at the inner base of each feeler: the eyes are dark and prominent: the mouth is green, and hardly reaches the base of the middle legs; its tip is black: the feelers are black, rather stout, and much longer than the body; the first and the second joints are green, and rather thick; the fourth joint is shorter than the third; the fifth is longer than the fourth; the sixth is hardly one-fourth of the length of the fifth; the seventh is slender, setaceous, and longer than any of the preceding joints: the nectaries do not rise above the surface of the abdomen: the legs are long, green, pubescent, and rather stout; the shanks are rather darker and much longer than the thighs; the hind shanks are nearly twice the length of the hind thighs; the knees and the tips of the feet are darker than the shanks: the wings are colourless and much longer than the body; the wing-brand is black and nearly half the length of the whole wing; the veins are brown; the third branch is divided before one-third, and subdivided before two-thirds of its length.

Length of the body $1\frac{3}{4}$ line; of the wings $5\frac{1}{2}$ lines.

The viviparous wingless female. Dark brown, broad, short,

thick, elliptical : the front is slightly convex and very broad, and there are no spines between the feelers : the feelers are black, stout, and much longer than the body; the first and the second joints are thick and dark brown; the third is rather short; the fourth is as long as the third; the fifth is a little longer than the fourth; the sixth is about half the length of the fifth; the seventh is as long as the third, fourth and fifth together : the legs are stout and very short; the shanks are longer than the thighs. In other characters it resembles the winged female. Found in August.

Length of the body 1 line.

The winged male. Scarlet : like the winged female but smaller, and having a rather narrow front : the eyes also are more prominent than those of the female : the mouth has a black tip, and reaches the base of the middle legs : the lobes of the chest, the breast, and the sexual parts are brown. In one insect the second fork of the third branch-vein in one wing is twice the length of that in the other wing.

Length of the body $1\frac{1}{4}$ line; of the wings 3 lines.

Sixth Group.

Containing only one species, and represented by four forms, which are—the winged viviparous female, the wingless oviparous female, the wingless male, and the winged male.

8. *Aphis Tiliæ*, Linn.

Aphis Tiliæ, Linn. Syst. Nat. ii. 734. 11; Faun. Suec. 984; Fabr. Sp. Ins. ii. 388. 34; Ent. Syst. iv. 218. 39; Syst. Rhyn. 299. 39; Leeuwenh. Lettr. 1696, 293, 294; Frisch. Ins. xi. 1. 3. t. 17; Geoff. Ins. iii. 1. 495. 6; DeGeer, Ins. iii. 77. 12. t. 5. f. 1–6; Schrank, Faun. Boic. ii. 1. 117; Latr. Gen. iii. 173; Burm. Handb. Ent. ii. 95. 5; Curtis, Brit. Ent. 577; St. Farg. et Serv. Enc. Méth. x. 247; Fonscol. Ann. Soc. Ent. x. 182. 25; Sir Oswald Mosley, Gardener's Chronicle, i. 684; Kalt. Mon. Pflan. i. 129. 99; Ratz. Forst. Ins. iii. 219.

This pretty Aphis feeds on *Tilia rubra*, the common lime-tree; *T. platyphylla*, the broad-leaved lime; and on *T. americana*, the American lime.

The viviparous winged female. Is hatched from the egg in the middle of April, or rather later in the year: it is then nearly oval, rather flat, and of a bright lemon colour : the feelers are about half the length of the body; the tip of each of their joints and the tip of the mouth are brown : the eyes are dark red : the nectaries are extremely short. The wings are unfolded in the beginning of June, and for a while after this operation the body is pale yellow, and the wings are milk-white and spotless :

it is afterwards bright yellow: the sides of the head and of the chest are brown, which colour adds to the linear appearance of the body by forming two continuous lines with the fore-borders of the upper wings when they are at rest: the forehead is convex and somewhat notched: the feelers have alternate black and yellow rings, and are nearly as long as the body; the fourth joint is rather more than half the length of the third; the fifth is a little shorter than the fourth; the sixth is shorter than the fifth; the seventh is much shorter than the sixth: the eyes are bright red: the tip of the mouth and the hind-thighs, except the base, are black: the fore-chest is large, a little narrower in front; its sides are slightly indented: the wings are colourless and much longer than the body; the wing-brands are dark brown; the veins are brown, and their tips are much shaded; the second branch-vein is curved. The pupa is pale yellow and elliptical; the tips of the joints of the feelers are black; the tip of the mouth and the tips of the feet are brown: the young ones within its body are very small.

1st variety. *Pupa.* White and shining: there is a black spot on each side of the chest, and on each side of the abdomen there is one distinct row and a slight indication of a second and outer row of black spots: the tips of the joints of the feelers, the tip of the mouth, and the feet are black.

2nd variety. Body varied with lemon colour or pale yellow.

3rd variety. Body yellow with four rows of black dots along the back.

4th variety. Body bright orange with a row of black spots on each side.

It is the prey of an *Aphidius*, and I believe that *Myina flava* is also one of its parasites. It has sometimes two dozen young ones within its body, and about twelve of these are of large size, the rest are smaller.

Length of the body $1\frac{1}{4}$ line; of the wings $2\frac{1}{2}$ lines.

There is a small tubercle on the inner side of the base of each feeler: the main vein of the wing is very strong; the space between it and the fore-border is yellow along its whole length, but the brand is sometimes colourless with the exception of its border, which is shaded; the first branch-vein is nearly straight; the second is curved; the third is slightly curved and is distinct till very near its source; it is forked before one-third, and is forked again before two-thirds of its length: the inclination of the main vein both inwards and outwards is very slight: the legs are of moderate length, and the fore-legs are but very little shorter than the hind-legs.

The oviparous wingless female. This appears in September, and continues beneath the lime-leaves till near the end of October:

it is oval, yellow, rather flat and hairy, and has four rows of black spots on the back, and these spots are often confluent so as to form bands : the feelers are black, and nearly as long as the body, but sometimes they are very much shorter; the base of each joint is yellow; the fourth joint is very much shorter than the third, but more than half its length; the fifth joint is as long as, or a little longer than the fourth; the sixth is a little shorter than the fifth; the seventh is more or less shorter than the fifth, and its base does not occupy the whole breadth of the tip of the latter: the fore-chest is broader in proportion to its length and narrower in front than that of the winged female: the abdomen beneath has a shield-like plate on each side near its tip : the hind-shanks are broad; the tips of the fore-thighs and of the middle-thighs, the hind-thighs from the middle to the tips, and the base of the hind-shanks are grayish black: the feet with the exception of the base are black. The eggs which it bears are about six in number.

1st variety. The abdomen above is nearly black, all its spots being confluent.

While this oviparous female is employed in laying eggs, the viviparous mother still continues to bring forth young ones which quickly perish by the fall of the leaves where they are seated; these leaves while fading on the tree are frequented by little white half-transparent *Acari*.

The wingless male. It has much resemblance to the wingless female, with which it pairs in September.

The winged male. This appears in September and October, and then pairs with the wingless female: it is brown : the head and the chest are slightly marked with yellow : the abdomen is yellow, and has a brown border: the feelers are black, and much longer than the body : the legs are yellow; the hind-thighs, except the base, the base of the hind-shanks, and the tips of the feet, are black; the knees, and the tips of the shanks are gray : the tips of the wing-veins are less shaded than those of the female usually are, but the colour of the body is darker than in that sex.

Seventh Group.

The viviparous wingless females appear in this group, but it is distinguished by the great predominance of the winged female, and is scattered and not clustering on its habitation. The veins of the wings are usually more or less clouded.

9. *Aphis Betulicola*, Kaltenbach, Mon. Pflan. i. 44.

The viviparous wingless female. This appears in July, but is of rare occurrence; it is pale orange and oval; the back is slightly convex and rather hairy: the middle-chest and the hind-chest

are undeveloped as is usual in wingless Aphides, but in other characters it resembles the winged female. The body and the legs are bristly: the front is slightly convex in the middle, and has a tubercle crowned with a tuft of bristles on each side: the body is nearly spindle-shaped and often appears quite full of young ones: the feelers are as long as or longer than the body; the fourth joint is very much shorter than the third; the fifth is a little shorter than the fourth; the sixth is about half the length of the fifth; the seventh is nearly as long as the fifth; the tips of the joints from the third to the sixth are brown: the fore-legs are not much shorter than the hind-legs; the shanks are straight: the nectaries are about one-twentieth of the length of the body.

A variety of this form has the body quite round, and pale yellow: the limbs are white: the feelers are longer than the body; the fourth joint is as long as the third; the fifth is a little longer than the fourth; the sixth is more than half the length of the fifth; the seventh is much longer than the fifth; the tips of some of the joints are black: the legs are very slender and rather short.

Another variety has much stouter legs than usual.

The viviparous winged female. This feeds on the leaves of the birch-tree (*Betula alba*) from July to October, but is more scarce than *Aphis Betulæ*: its colour is bright yellow, and its back is slightly hairy: the forehead has a slight protuberance on each side: the feelers are yellow, slender, and much longer than the body; the tips of the joints are brown; the third joint is very long; the fourth is much shorter than the third; the fifth is a little shorter than the fourth; the sixth is slightly clavate, and about one-third of the length of the fifth; the seventh is as long as the sixth: the eyes are dark red: the mouth is yellow; its tip is brown: the nectaries are extremely short, and not more than one-twelfth of the length of the body: the legs are yellow, long and slender; the feet, the knees, and the tips of the shanks are brown: the wings are colourless; the wing-ribs, the wing-brands and the veins are tawny; the tips of the latter are slightly clouded; the first and second branch-veins are more perpendicular to the rib-vein than in most species of this genus; the first is thick; the fourth is obsolete except at its tip.

The length of the fore-chest is not less than its breadth; its sides are convex: the legs are very slender; the shanks are slightly curved: the main vein begins at three-fourths of the length of the wing to widen into the wing-brand which is irregularly spindle-shaped; the fourth vein is obsolete except at its tip; the third vein is obsolete at its source, and is forked before one-third of its length and forked again before two-thirds of its length; the branches of the forks, and especially of the second fork, diverge rather abruptly from each other; the second vein is rather per-

pendicular to the main vein, and the first vein still more so; and this structure of the veins is peculiar to the group of species to which this, with *A. Quercus, Quercea, Alni, Coryli, Juglandicola, Platanicola*, &c., belongs; the first and the second veins are distinctly joined to the main vein: the legs are very slender.

1st variety. Yellow speckled with orange.

2nd variety. Orange.

3rd variety. Pale red.

Sometimes the lower branch of the first fork of the third vein is wanting; in another case the lower branch of the second fork is wanting; and in the other fore-wing of the same insect the first branch-vein is quite wanting; the second and the third do not reach the border of the wing; the second has a short fork, but the third has none.

The oviparous wingless female. This appears at the end of September: it is orange, nearly oval, and the tip of the abdomen is slightly produced into a tube: the limbs are yellow: the feelers are shorter than the body; the sixth joint is about half the length of the fifth; the seventh is longer than the sixth; the tips of the joints and the tip of the mouth are brown: the hind-shanks are slightly dilated.

The winged male. This resembles the winged female, but its colour is darker: the head, the disc of the fore-chest, the lobes of the middle-chest, a spot on each side of it, and a row of short bands along the back of the abdomen are brown. It pairs with the oviparous female at the end of September and in the beginning of October.

The bright yet delicate colour of this species makes it a beautiful object.

Length of the body $1\frac{1}{4}$—$1\frac{1}{2}$ line; of the wings $3\frac{1}{2}$—4 lines.

10. *Aphis Juglandina*, n. s.

The viviparous winged female. The body is nearly linear and rather broad: the head is broad; the front is very prominent, and forms a right angle: the feelers are a little longer than the body; the fourth joint is a little more than half the length of the third; the fifth joint is a little shorter than the fourth; the sixth is a little less than half the length of the fifth; the seventh is rather less than twice the length of the sixth: the body is pale buff, and has a dark line along the back of the head and of the fore-chest whose sides are deeply notched: the nectaries hardly rise above the surface of the abdomen: the legs are yellow and of moderate length; the feet and the tips of the shanks are darker; the fore-legs are but little shorter than the hind-legs: the wings are colourless and rather long; the main vein is inclined as usual, first inwards, then outwards, where it forms a very obtuse

angle; it is not widened into a distinct brand, though that part of the wing is yellow, and clouded at the base and at the tip; the branch-veins are not straight; their tips are clouded; the first vein is not so perpendicular as in *Aphis Alni* and other species; the third vein is distinct till very near its source; it is forked some way after one-third of its length, and forked again long after two-thirds of its length; the fourth vein is very distinct along its whole length.

Length of the body $\frac{3}{4}$ line; of the wings $2\frac{1}{2}$ lines.

A single specimen found on the walnut near London, August 3rd, 1847.

11. *Aphis Coryli*, Götze.

Aphis Coryli, Götze, Ent. Beiträge, ii. 311; Sir Oswald Mosley, Gardener's Chronicle, i.; Kalt. Mon. Pflan. i. 98. 73.

This delicate little Aphis feeds on the hazel (*Corylus Avellana*), on the hornbeam (*Carpinus Betulus*), and, as Kaltenbach states, on the ash (*Fraxinus excelsior*).

The viviparous wingless female. This appears beneath the leaves at the end of March or later: it is then pale green, bristly, and rather long and narrow: there are four rows of brown spots along the body, and a bristle comes forth from each spot: the feelers are brown, and nearly one-half the length of the body: the eyes and the tip of the mouth are brown: the nectaries are extremely short: the legs are pale green.

1st variety. The feelers and the legs are dark dull green.

The viviparous winged female. This, while a pupa, at the end of April, has a citron or pale yellow colour: there are four rows of tubercles along the back, which is thickly covered with brown bristles: the eyes are red: the feelers are full half the length of the body; the tips of their joints and the feet are brown. The wings are unfolded in the middle of May, and the insect has then a beautiful citron colour: the tips of the feelers, the tip of the mouth, the feet, and the tips of the shanks are brown: the feelers are as long as or a little longer than the body; the fourth joint is a little shorter than the third; the fifth is much shorter than the fourth; the sixth is much shorter than the fifth; the seventh is as long as the fifth: the wings are colourless; the wing-ribs and the wing-brands are pale yellow, and there is a small brown spot on each of the latter; the veins are also pale yellow, and their tips are slightly clouded: the first branch-vein is somewhat perpendicular to the wing-rib, as in *A. Alni*, &c. The front is prominent: the sides of the fore-chest are notched: the legs are moderately long; the fore-legs are but little shorter than the hind-legs: the main wing-vein does not widen into a brand; it is very slightly inclined inwards and outwards, forming a very ob-

tuse angle or a curved line along the lower border of the brand which it incloses : the branch-veins are nearly straight ; the third vein approaches very near to the main vein ; it is forked at one-third, and forked again at two-thirds of its length.

The oviparous wingless female. This appears in October, and continues beneath the leaves till the end of November ; it is often orange, and this colour is owing to its eggs, which are attached to the twigs in November.

12. *Aphis Quercus,* Kaltenbach.

Aphis Quercus, Kalt. Mon. Pflan. i. 98. 74 ; Ratzeburg, Forst. Ins. iii. 217.

This and *A. Quercea* are very pretty, and great ornaments to the oaks on which they feed ; they have a mutual likeness, but may be distinguished from each other by the following characteristics : the colour of *A. Quercus* is usually green, yellow, or orange ; the feelers are never much longer than the body, and the nectaries have black tips ; *A. Quercea* has a rosy hue, its feelers are much longer than the body, there are two hooks on the back of its abdomen, and black spots on the tips of its thighs.

The front of *A. Quercus* is nearly straight, or slightly notched ; there are no tubercles at the base of the feelers, whose fourth joint is much shorter than the third ; the fifth is still shorter than the fourth ; the sixth is nearly half the length of the fifth ; the seventh is longer than the sixth : the fore-chest is subquadrate, rather narrower in front ; its breadth slightly exceeds its length ; the sides are undulated. The feelers vary in length, but are usually longer than the body ; the fifth joint is sometimes as long as the fourth, and the sixth full half the length of the fifth, and the seventh but very little longer than the sixth. It differs from *A. Quercea* in its broader head and front, in its shorter legs, in having no horn or hooks on the abdomen, in the broad black tips of each joint of its feelers, and in its black-tipped nectaries : the sides of the fore-chest are sometimes nearly straight : the wing-veins are more straight than those of *A. Quercea* ; the main vein, somewhat beyond the middle of the fore-border, expands into a yellow irregularly spindle-shaped brand, which has a dark spot at its base ; the angle formed by the vein on the lower border of this brand is much more obtuse than that of *A. Quercea* : the thighs are not spotted : the first branch-vein is more perpendicular to the main vein than is that of *A. Quercea* : the front of the head is often a little notched, and armed with bristles.

The viviparous wingless female. This appears at the end of April or later : it is then pale yellow, very small, narrow and linear, and has four rows of brown spots along the back, each of them sending forth a bristle : the feelers are stout, dull brown,

sometimes yellow at the base, and about half the length of the body: the eyes are brown: the mouth is pale yellow with a brown tip: the nectaries do not appear beyond the surface of the abdomen: the legs are dull brown, short and stout. It acquires its full growth before the middle of May, and is then oval, slightly convex, very pale lemon colour or almost white, half transparent, and much less hairy than *A. Coryli*: the feelers are pale yellow, and more than half the length of the body: the eyes have a gold colour: the mouth and the legs are pale yellow, and the latter are moderately long: there are sometimes twenty young ones in the body.

The viviparous winged female. This, as a pupa, is very abundant before the end of May; it is nearly elliptic and rather flat, and of a delicate pale green or yellow colour: the eyes, the feet, and the tips of the joints of the feelers are brown. It acquires wings at the end of May, and then varies much in colour, but it usually has a bright lemon hue; the feelers are a little shorter than the body: the tips of the joints are brown: the eyes are dark brown: the mouth is pale yellow with a brown tip: the nectaries also are yellow with brown tips, and not one-twentieth of the length of the body: the legs are yellowish white: the wings are colourless, and longer than the body; the wing-ribs, the rib-veins, and wing-brands are pale yellow; the other veins are almost white.

1st variety. Yellowish green, varied with black which prevails on the middle chest: there are four rows of black spots on the back of the abdomen; the two middle rows are sometimes confluent, and form short bands: the feelers are black: the legs are yellowish green, the knees and the feet are darker: the fore-border of the upper wing is tinged with brown, there is a small brown spot at its tip, and one also at the tip of each branch-vein.

2nd variety. Of a bright lemon colour: the disc of the chest is pale orange: there is a pale brown stripe along the head, and three stripes of the same colour along the fore-chest: the middle chest is slightly streaked with pale brown: there are four rows of brown spots on the back of the abdomen: the feelers are brown, pale yellow at the base, and about half the length of the body: the eyes are red: the nectaries are brown: the legs are pale yellow; the feet, the tips of the shanks, and the tips of the hind-thighs are brown: the wing-veins are brown, and their tips are clouded.

3rd variety. Its colour is a fresh and delicate green: the disc of the chest is pale tawny: the eyes are dark green: the feelers are white; the tips of their joints are brown: the legs are pale yellow; the hind-thighs are pale green; the feet are brown.

4th variety. Bright yellow, having a brown line along the head and the chest, and a line of the same colour on each side of the latter, which has also a small brown spot at its tip: there are four rows of brown spots on the abdomen: the tips of the shanks are brown.

During the summer it has many other tints of yellow and of green, more or less varied with brown and black. During the spring of 1846 I found it in abundance feeding on the dwarf chestnut (*Castanea pumila*), a native of America, but with this exception the oak seems to be its only support.

There are two other varieties of *A. Quercus*: in the first the body is rather short and nearly linear, and the head is as broad as the chest; in the second the body is longer, and increasing in breadth from the head till near the tip of the abdomen, and the head is narrower than the chest.

The oviparous wingless female. Its season is from the middle of October to the end of November: the variableness of its colour is partly owing to the orange eggs which it incloses: it is often bright yellow and has a lively green stripe on each side of the body: the abdomen is not a little lengthened behind: the feelers are pale yellow; the tips of the joints are black: the legs are pale yellow; the hind-shanks sometimes and especially towards the base are slightly dilated, and of a rather darker colour than the other shanks.

1st variety. Yellowish green.

2nd variety. Pale orange.

3rd variety. Brilliant orange with a pale yellow or pale green head. It has also various tints of green and of yellow.

The body slightly increases in breadth from the head till near the tip of the abdomen: the feelers are much shorter than the body: the front of the head is beset with bristles: the sides of the fore-chest are not notched: the legs are rather short.

The winged male. It appears in the autumn, and pairs with the oviparous wingless female in October: it is grass-green: the disc of the chest is black, and there is a broad black line along the disc of the abdomen: the feelers and the eyes are black, and the former are longer than the body; the fourth joint is much shorter than the third; the fifth is shorter than the fourth; the sixth is much shorter than the fifth; the seventh is a little longer than the sixth: the legs are pale yellow; the thighs are pale green, and with the exception of the fore-thighs they are shaded with black.

1st variety. Buff: the abdomen is dull buff marked with black, and has a row of black spots on each side: the nectaries are also black.

The wing-veins are much more strongly marked than those of

the female, and they are hardly clouded: the feelers, like the legs, are tawny, and their joints have not black tips; they are much thicker than those of the female, with the exception of the seventh joint, which is much more slender and rather shorter than the sixth: the nectaries are paler than those of the female, whose wing-brand is sometimes colourless like that of *A. Quercea.*

Length of the body $1\frac{1}{4}$ line; of the wings 3 lines.

13. *Aphis Quercea,* Kaltenbach.

Aphis Quercea, Kalt. Mon. Pflan. i. 136. 104; Ratzeburg, Forst. Ins. iii. 218.

The viviparous winged female. The front of the head is notched or crenulate, but without tubercles at the base of the feelers, which are very much longer than the body; the fourth joint is very much shorter than the third; the fifth is much shorter than the fourth; the sixth is about half the length of the fifth; the seventh is a little longer than the sixth: the sides of the fore-chest are notched: the back of the abdomen near the base bears a horn armed with two forks or hooks: the nectaries are not more than one-twelfth of the length of the body: the legs are long and slender; the fore-legs are not much shorter than the hind-legs; there is a dark spot at the tip of each thigh: the tip of the abdomen, as in the other species of this group, is not compressed nor sickle-shaped: the feelers and legs of the pupa, which often has a beautiful rose colour, are shorter than those of the winged insect, and the young ones are very clearly seen in the body of the former, whose horn is very short and indistinct. The fourth joint of the feelers is sometimes not more than half the length of the third; and the fifth is as long as the fourth; and there are gradations between these varieties: the sides of the fore-chest and the front of the head are sometimes straight, and sometimes notched: the wings are colourless; the veins are not straight; the main vein does not widen towards its tip as in other species; it is bent first inwards, then outwards, where it forms an angle from whence springs the fourth vein, and it is clouded at each end of the sides of this angle; the first branch-vein is rather perpendicular, and like the second is joined to the main vein; the third does not quite join the main vein, but comes very near to it, and is forked a little after one-third and forked again a little after two-thirds of its length; its base is quite clear, but in the other veins that part is slightly clouded: the brand is sometimes coloured like that of *A. Quercus,* but it is always shorter: in *A. Quercus* the seventh joint of the feelers is a little shorter than the sixth; in *A. Quercea* it is a little longer: in both these species the third branch-vein is more slender and less distinct than the first or the second veins; however, when the wings are just un-

folded, and as yet milk-white, and slightly opake, all the veins have the same thickness, and then also the third vein is more clearly defined close to its source, and the widening of the main vein into the brand is more distinct. The wing-brand sometimes forms a curve along its hind-border, the angle being obsolete.

The oviparous wingless female. The body is rose colour, and gradually increases in breadth from the head to near the tip of the abdomen, and as is usual in this generation is somewhat attenuated behind the nectaries : the feelers are shorter than the body : the legs are shorter than those of the winged female ; the hind-shanks are hardly or not at all dilated, and this variation also occurs in *A. Quercus* : the body of the latter species is more lengthened towards the tip than that of *A. Quercea,* and the feelers of the former are shorter than the body.

Length of the body 1 line ; of the wings 2½ lines.

14. *Aphis Alni,* Fabr.

Aphis Alni, Fabr. Ent. Syst. iv. 215. 26 ; Syst. Rhyn. 298. 26 ; Gmelin, Syst. Nat. i. 2206; DeGeer, Ins. iii. 47. 4. t. 3. f. 15–17 ; Latr. Gen. iii. 173 ; Kirby and Spence, Intr. Ent. iii. 76 ; St. Farg. et Serv. Enc. Méth. Hist. Nat. x. 248 ; Kalt. Mon. Pflan. i. 137. 105 ; Ratz. Forst. Ins. iii. 219.

A. maculata, Von Heyden, Mus. Senk. ii. 297 ; *A. punctipennis*?, Zetterstedt.

This Aphis feeds on the alder (*Alnus glutinosa*) from the beginning of May till the end of November. It is a scattered species.

The viviparous wingless female. When young it is linear and white, but when full-grown it is very pale whitish green, half-transparent, nearly oval, hairy, and rather flat : there are three large transverse vivid green spots on the back ; the second one reaches nearly across, and is almost or quite divided in the middle : the front is slightly convex : the feelers are shorter than the body ; the fourth joint is much shorter than the third ; the fifth is shorter than the fourth ; the sixth is a little more than half the length of the fifth ; the seventh is shorter than the sixth : the tips of the joints of the feelers, the eyes, the tip of the mouth, and the feet are black : the nectaries are extremely short. In May.

1st variety. The feelers are a little longer than the body.

2nd variety. A black spot near the tip of each hind-thigh.

The young ones in the body are twenty and upwards in number.

The viviparous winged female. This unfolds its wings in the beginning of May : it is yellow : the head and the chest are chiefly dark green ; their sutures and borders are pale green : the abdo-

men is traversed by bands like those of the wingless female: the feelers are as long as or a little longer than the body; the tips of their joints, and sometimes the whole of them excepting the base, are black: the eyes, the tip of the mouth, the tips of the nectaries, the feet, and the hind-thighs from the middle to the base, and sometimes the whole of them, are black; there is also a black ring round each middle thigh: the wings are colourless; the wing-ribs and the rib-veins are pale yellow; the wing-brands are colourless; the first branch-vein is strongly marked; the fourth is more or less wanting; the tips of the veins are slightly shaded.

The body is rather short and broad; the middle of the front of the head is prominent and armed with bristles: the first joint of the feelers has a black spot on its inner side; the fourth joint is very much shorter than the third; the fifth is as long as the fourth; the sixth is full half the length of the fifth; the seventh is shorter than the sixth: the sides of the fore-chest are convex and slightly notched: the legs are moderately long; the fore-legs are much shorter than the hind-legs: the main wing-vein is slightly curved inwards and outwards, and is somewhat clouded on the inner side at its tip, but does not form a distinct brand; the first branch-vein is nearly perpendicular; the second and the third are strongly marked towards the base; the latter is very distinct till close to its source, and sends forth its forks at one-third and at two-thirds of its length; these forks are very slender, and, as in other species of this group, they are much diverging from each other.

1st variety. The abdomen is not traversed by bands.

2nd variety. The head and the chest are almost black.

3rd variety. The sutures of the chest are yellow.

4th variety. The head is black: the disc of the chest is brown.

5th variety. The whole of the hind-thighs is black.

6th variety. The tips of the middle thighs are brown or black.

The main wing does not form an angle but a curve beneath the place of the brand; the third vein is sometimes forked after one-third, and again after two-thirds of its length: all the veins have the same thickness when the wings are just unfolded.

The oviparous wingless female. This occurs in October and continues till the end of November: it is pale yellow varied with green: the feelers are black about the middle, and more than half the length of the body: the tips of the feet are also black: the tip of the abdomen is lengthened: the hind-shanks are dilated.

1st variety. Pale yellow varied with bright yellow.

2nd variety. Pale yellow varied with orange.

3rd variety. Pale greenish yellow, with a lively irregular green stripe on each side.

4th variety. Feelers not more than half the length of the body. On each side of the abdomen there is a bundle of white floccose matter like spun-glass ready to be used, as is said, as wrappers for the eggs when they are laid; these eggs are four or five in number, of an orange colour, which they communicate to the half-transparent body.

Length of the body 1 line; of the wings $2\frac{1}{2}$ lines.

The winged male. Its colour does not differ from that of the winged female: it lives in October and November, and then pairs with the wingless female.

15. *Aphis Juglandicola.*

Lachnus Juglandicola, Kalt. Mon. Pflan. i. 151. 4.

The viviparous wingless female. Appears in July; it is yellow, oval, flat, and hairy: the feelers are not quite one-fourth of the length of the body.

The viviparous winged female. This dwells on the underside of the leaves of *Juglans regia,* the walnut-tree, from July to October: while a pupa it is yellow, flat, hairy, nearly elliptical, and has two rows of brown spots along the back; there are usually seven spots, often less, but very rarely more, in each row: the front is broad, convex between the eyes and prominent in the middle: the limbs are pale yellow: the feelers are not more than one-fourth of the length of the body; the tips of their joints and the tip of the mouth are brown. When winged it is yellow: the feelers are less than half the length of the body; the tips of the joints are brown; the third joint is long; the fourth is much shorter than the third; the fifth is hardly shorter than the fourth; the sixth is much shorter than the fifth; the seventh is extremely short and about one-fourth of the length of the sixth: there are no tubercles at the base of the feelers: the eyes are red: the nectaries are extremely short: the legs are yellow, and there is a brown spot near the tip of each hind-thigh: the wings are colourless; the wing-ribs and the rib-veins are yellow; the wing-brands are colourless; the base of each branch-vein and the tips of the rib-veins are slightly clouded; the first and the second branch-veins descend abruptly to the hind-border of the wing, as in *Betulicola, Alni,* &c.; these veins become very faint as they approach the hind-border.

1st variety. A spot on the tip of each of the middle thighs.

2nd variety. The wing-brands slightly clouded.

3rd variety. A brown spot on each side of the back of the abdomen.

4th variety. Body yellow intermingled with orange.

5th variety. Body orange.

The body is rather short and broad: the front of the head and

the sides of the fore-chest are notched: the legs are rather short; the fore-legs are but little shorter than the hind-legs; the wings are somewhat small; the main vein widens into the brand a little beyond the middle of the fore-border of the wing; its inclination inwards and outwards is very slight; the brand is very pale yellow, irregularly spindle-shaped, and forms a very obtuse angle along its hind-border; the branch-veins are slightly curved, and very slender except at the base; the third vein is distinct at its source, it is forked a little beyond one-third, and forked again a very little beyond two-thirds of its length; the fourth is very short; the first vein is perpendicular to the main vein. The third vein sometimes sends forth its forks a little before one-third and two-thirds respectively of its length.

It is infested by an *Aphidius* and by an *Allotria*.

The oviparous wingless female. This appears in the beginning of August, and sometimes does not disappear before the middle of October: the body is nearly elliptical, and sometimes all yellow, but more often the middle chest is brown, and there is a broad brown band across the abdomen whose tip is slightly lengthened: the limbs are yellow; the feelers are not half the length of the body: the hind-shanks are broad, and there is a black spot at the tip of each thigh.

The winged male. Like the winged female, but more slender: the sides of the body are almost black: the head and the middle chest are brown, and there are four brown spots on the back of the abdomen: the veins of the wings are more distinctly marked than in the female, and the wing-brands are darker and shaded at both ends: the feelers are yellow, and very nearly as long as the body; the first and the second and the tips of the following joints are brown: the tips of the hind-thighs and the base of the hind-shanks are slightly clouded: there is a small brown spot at the tip of each thigh: the tips of the feet are black.

1st variety. The hind-thighs and the hind-shanks are black, excepting the base of the former and the tips of the latter.

2nd variety. The sides of the abdomen are brown, and there are two spots of the same colour in a line on its back.

Length of the body 1 line; of the wings 2 lines.

16. *Aphis Platanicola.*

Lachnus Platanicola, Kalt. Mon. Pflan. i.

The species is not a native of England, and the following notes are taken from specimens given to me by Professor Kaltenbach of Aix-la-Chapelle, in whose work on Aphides it is more fully described. Perhaps it should form part of the following group.

The viviparous winged female. The body is orange, and rather broad; the abdomen is black: the feelers are yellow at the base,

and nearly as long as the body; the tips of the third and of the following joints and the whole of the latter joints are black; the fourth joint is rather more than half the length of the third; the fifth is very much longer than the fourth; the sixth is a little shorter than the fifth; the seventh is extremely short, and almost obsolete: the nectaries are extremely short: the legs are yellow; the feet and the tips of the thighs and of the shanks are darker: the wings are colourless; the veins are like those of *A. Alni*, but less straight and much more clouded; the third vein sends forth its first fork a little beyond one-third and its second fork a little beyond two-thirds of its length; the fourth vein is sometimes obsolete, sometimes indistinctly visible.

Length of the body 2 lines; of the wings 5 lines.

[To be continued.]

XXXVII.—*Note on the Cyclostomatous genus* Pterocyclos, *Benson* (Steganotoma, *Troschel*). By W. H. Benson, Esq., late Bengal Civil Service.

Among Dr. Philippi's 'Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien,' vol. i. Cassel, 1842–45, appear two species of operculated land-snails under the generic title of *Steganotoma*, Troschel, as founded by that author in 'Wiegmann's Archiv für Naturgesch.' for 1837, on his species *S. pictum*. This genus was anticipated by me under the name of *Pterocyclos* in the 'Journal of the Asiatic Society of Calcutta' for January 1832, vol. i. pp. 11–14, pl. 2, on a shell which I had discovered in the province of Bahár in the previous year. Three capital figures of my third variety of *Pterocyclos rupestris*, drawn and engraved by the lamented James Prinsep, Secretary of the Society, accompanied the paper. Six years subsequently Troschel published the type of the identical species, described in the Indian Journal, as new.

In November 1833 Dr. Pearson (J. A. S. vol. ii.) added two species (*hispidus* and *parvus*) under the generic name of *Spiraculum*, from the north-east frontier of Bengal, which were figured by Prinsep in tab. 20 of that volume.

In the fifth vol. of the 'Zool. Journal' for 1834, p. 462, the attention of conchologists was called to the genus *Pterocyclos* in a slight notice. In June 1836 I published, in vol. v. of the J. A. S., further observations on the genus (after discovering the animal inhabiting the shell), together with remarks on its singular operculum, and on Dr. Pearson's two species, adding also the comparative characters of the living animals of *Pterocyclos* and *Cyclostoma*.

In 1837 (as before mentioned) Troschel's character of *Stega-*

notoma appeared. In 1843 Sowerby published his monograph of *Cyclostoma*, including a new species, *C. bilabiatum* (for which "*Pterocyclos*, Benson," was given as a synonym), and refigured Pearson's *hispidus* as *C. spiraculum*. In March 1844 Pearson's *hispidus* suffered a further change of name, being published in Philippi's work under Von dem Busch's name of *Steganotoma Princepsi*, and *Pt. rupestris* was again figured as *St. pictum*, Trosch.: Prinsep's name (with an erroneous spelling) being affixed to the former species, it is possible (though the source is not acknowledged) that the specimen was originally derived from him, in which case it was unfortunate that the shell should not have been accompanied by a note of the previous publication of the genus and species.

The following are the species known to me, with their synonyms. Nos. 4 and 5 are I believe as yet undescribed. Coloured figures of them by Dr. Bland were sent to me for inspection by Prinsep. The original shells may yet be forthcoming in some English collection.

1. *Pterocyclos rupestris*, Benson, J. A. S. vol. i. January 1832, pl. 2.
   Steganotoma pictum, Troschel, Wieg. Archiv, 1837; Abbildung. Phil. 1844.
2. *Pt. hispidus** (*Spiraculum*), Pearson, J. A. S. vol. ii. 1832.
   Cyclostoma spiraculum, Sow. Thes. Conch. 1843.
   Steganotoma Princepsi, V. d. Busch, Abbild. 1844.
3. *Pt. parvus* (*Spiraculum*), Pearson, *loc. cit.* pl. 20.
4. *Pt.* —— (unnamed), note by Dr. Bland, J. A. S. vol. v. p. 783, Ceylon.
5. *Pt.* —— (ditto), Dr. Bland, *loc. cit.* Pulo Susson near Pulo Pinang.
6. *Pt. bilabiatus* (*Cyclostoma*), Sowerby, Thes. Conch. 1843.

Dr. Philippi alludes to a species in the possession of Dr. Pfeiffer which is undescribed, unless it be *P. parvus* or *bilabiatus*, to which last Dr. Philippi has not adverted in the 'Abbildungen.' His arguments for the separation of the genus from *Cyclostoma*, in opposition to the opinion of Deshayes, grounded on the analogy to *Pleurotoma* afforded by the slit in the lip, and on the thimble-shaped operculum, are worthy of attention. The planorbular

* Since the above went to press I find that Dr. Pfeiffer has, in the 'Zeitschrift' for 1846, p. 35, under the head of *Cycl. bilabiatum*, Sow., acknowledged the priority of *Pterocyclos*, Benson, to Troschel's *Steganotoma*; and has referred *bilabiatum*, and *spiraculum*, Sowerby, to *Pterocyclos*. He gives *C. angulifera*, Souleyet, 'Rev. Zool.' 1841, as synonymous with *C. spiraculum*, and proposes to cancel Sowerby's name in favour of the latter; both, however, must give place to Dr. Pearson's specific name of "*hispidus*."

Cyclostomata from the same quarter have opercula wound on a plane, as in a new species found by Dr. Jerdon in the Nilgherries, or beautifully ornamented and projecting beyond the peristome, as in *C. cornu-venatorium.* Of the last-named shell I lately took alive, near Point de Galle in Ceylon, specimens of a singular variety with a free deflected aperture analogous to that of *Cylindrella.*

XXXVIII.—*Description of some new Fossil Shells from Bissex Hill and Springfield in Barbados.* Communicated by Sir Robert H. Schomburgk, Ph.D., Member of the Imperial Academy Nat. Curios. &c.*

Fam. SCALARIANA, *Lam.*

Scalaria Ehrenbergi, *E. Forbes.* (Fig. 1.)

" S. testa brevi, obesa, ventricosa, anfractibus 5, longitudinaliter costulata, costis regularibus æqualibus, lamelliformibus, in ultimo anfractu 16; apertura rotundata, marginata.

"Shell ventricose and shortly conical, whorls about 5, rounded, longitudinally ribbed; the ribs equal, elevated and not thick, numerous, 16 on the body whorls: no spiral ridge on the base:

Fig. 1. Scalaria Ehrenbergi.
Fig. 2. Nucula Packeri.
Fig. 3. The same, showing the dorsal margin.
Fig. 4. Nucula Schomburgkii.
Fig. 5. The same, showing the dorsal margin.

marginal rib of the round aperture strong and high; columella broad and rather angulated at the base. Length $\frac{8}{10}$ of an inch: breadth $\frac{6}{10}$ of an inch.

"This remarkable species is allied to some tertiary forms, probably miocene. Among recent species its nearest ally is the *Scalaria crassilabrum* of Sowerby, jun., a species from the Philippines and Central America."

* The description of these interesting fossils is originally printed in my 'History of Barbados' (London, 1848, Longman, Brown and Co.); but as such a work possesses only local interest, and its circulation is consequently limited, it is not probable that naturalists in general would become acquainted with their description if it were restricted to the pages of that work. I have therefore requested the Editors to insert the account of these fossil shells in the 'Annals of Natural History.'—R. H. S.

I found this unique shell near the summit of Bissex Hill, imbedded in siliceous limestone. I am glad that my discovery of this new shell has afforded Professor Forbes an opportunity to name it after the learned Professor Ehrenberg, who, by his discovery of a new class of animalcules in the rocks of Barbados, has added another claim to our thanks for his indefatigable researches into the history of the most minute forms of organic life.

Mr. Edward Packer of Springfield forwarded to me during my stay in Barbados, a specimen of rock consisting of dark gray limestone inclosing small quartz pebbles, in which numerous shells of the genera *Nucula, Lucina, Pleurotoma* and *Venus* were so firmly imbedded as to form one mass. According to his description, this block lies isolated in the neighbourhood of Springfield, and I do not recollect having met with a similar rock *in situ* during my rambles in the island. I have to regret that the specimens of shells which I received from Mr. Packer were mostly very imperfect; this refers chiefly to the *Lucina* and *Pleurotoma*. One of the species of *Nucula* was very perfect, which, at my request, my friend Professor Forbes has named after Mr. Edward Packer, a gentleman who has taken great interest in my researches while in Barbados, and offered me many facilities in prosecuting them.

I have consented, not without some hesitation, to the specific name of the second species, upon which my kind friend Professor Forbes has insisted.

Fam. ARCACEA, *Blainv. and Lam.*

NUCULA (LEDA) PACKERI, *E. Forbes.* (Figs. 2 and 3.)

"N. testa oblonga, subtumida, transverse striata, longitudinaliter oblique unisulcata; latere postico productiore, attenuato, angulato, subacuto; antero rotundato; margine ventrali simplici, subsinuato; lunula oblongo-lanceolata, carinis elevatis cincta.

"Shell ovate or oblong, rather tumid, produced slightly retrally into a subcompressed acutely-angled beak, which is separated from the rest of the shell by a shallow furrow; the other extremity is rounded. The surface is crossed by very numerous transverse striæ with sharp intermediate ridges. The beaks are prominent. The lunule is well-defined and smooth, and bounded by two ridges, one of which is the margin of the upper part of the valves. The margins of the shell are smooth. Transverse dimension $\frac{8}{10}$ of an inch: beak to frontal margin $\frac{5}{10}$ of an inch.

"This form is allied to several existing tropical and subtropical *Nuculæ*, and to some crag forms.

NUCULA SCHOMBURGKII, *E. Forbes.* (Figs. 4 and 5.)

"N. testa ovato-elliptica, valde inæquilaterali, tumida, postice rotundata, antice abrupte truncata, lineis sæpe divaricatis sculpta; umbonibus subterminalibus; lunula lanceolata, marginibus denticulatis.

"Shell rather tumid, ovate, elliptic, very inequilateral, with the beaks nearly terminal at the truncated anteal extremity. The posteal extremity rounded. An arched furrow runs from the beak to the margin at the anteal extremity. This furrow is smooth; the space in front of it is terminated by about a dozen nearly perpendicular curved grooves, bounding a somewhat impressed, nearly smooth indistinct area. Between the arched groove and in front of the border of the lunule, all over the shell are fine curving divaricating furrows, forming a series of elegant angular markings. Towards the cardinal margin these furrows curve inwards, widen, and have thicker interspaces, so as to denticulate the borders of the lanceolate and nearly smooth lunule. The ventral margin appears to have had smooth lips. The cast is smooth. Dimensions of the most perfect specimen, from beak to posterior angle, $\frac{5}{10}$: central breadth $\frac{4}{10}$: thickness $\frac{3}{10}$.

"This remarkable shell belongs to a group of *Nuculæ*, of which there are few known species, either living or fossil. The oldest known members of the section occur in cretaceous strata: *Nucula bivirgata*, Sowerby, and *Nucula ornatissima*, D'Orbigny, both gault species, are examples. Still nearer the West Indian species is the *Nucula Cobboldiæ* of the crag, a species which lived on in the Celtic region of Europe till the elevation of the sea-bed of the glacial epoch caused its extinction. Two living *Nuculæ* represent this group, viz. *Nucula divaricata* and *Nucula castrensis*, both described by Mr. Hinds in the 'Zoology of the Voyage of the Sulphur'; the former was taken in twenty-four fathoms in the Chinese seas, and the latter dredged in seven fathoms, sand, at Sitka in North-West America."

XXXIX.—*On the Insects of Jamaica.* By Philip Henry Gosse.

[Continued from p. 270.]

63. *Brentus* (sp.). Taken on Bluefields Mountain early in June.

64. *Brentus* (sp.). Small. Taken in the same locality a day or two after the former.

65. *Brentus* (sp.). Intermediate in size between the preceding two. Taken at the Hampstead Road near the end of June.

66. *Pachnæus* (sp. near *opalus*). Numerous on the Hampstead Road in June, on low shrubs and herbaceous plants.

67. *Diaprepes Spengleri.* I found this weevil in some abundance on the stunted prickly trees growing in the Pedro Plains, about the middle of June. I also found it plentiful in the island of St. Thomas, about a month later.

68. ———? *impressus* (*Curculio impressus,* Fabr.). At the back of Content Cottage grows, at the edge of the forest, a towering mahogany-tree: the specimens (some ten or twelve) of this very conspicuous insect which I obtained, were all with one or two exceptions found on this tree. They were usually resting on the leaves or twigs at a great elevation, and we found them only by a careful and patient searching with the eye among the lofty foliage. When we observed one, we procured it by thrusting up a bag-net at the end of a pole, into which on the slightest shock it would fall. One specimen flew in at the open window of the cottage after nightfall, attracted by the lights. They occurred from the latter part of May to the end of June.

69. *Prepodes vittatus.* The first specimen I saw was brought to me in April, found among the grass at Bluefields. Straggling individuals were picked up now and then until the end of May, when the species became very numerous on Bluefields Mountain, and still more abundant on the Hampstead Road; continuing plentiful throughout June. We found them for the most part in the early part of the day resting on the leaves and twigs of the young trees that border and overhang the roads. Specimens differ much in size, and still more in beauty; for while in some, the longitudinal bands of alternate crimson and green that run down the elytra are perfect and brilliant, in others they are nearly defaced by rubbing, and the colours are changed to a dull brown and a dingy yellow.

70. *Prepodes* (sp. nov.). This is smaller than the preceding, and distinguished by the longitudinal bands being white. It is rather uncommon. I took three specimens almost together, on low bushes (*Lantana,* if I rightly remember) beside the road leading from Bluefields to Savanna le mer, about the middle of July; and another at Auld Ayr, near Bluefields, about the middle of August.

71. *Cæliodes*? (sp.). A few specimens were taken at Bognie, on Bluefields Mountain, about the beginning of June.

72. *Eurhinus* (sp. nov.). This is near *E. festivus,* but is still more lustrous than that lovely insect; the light reflected from its burnished surface is of an orange-red hue, and almost resembles that of a glowing coal. I obtained but three specimens; one of which was found on a bush at Belmont, early in June, and another on the Hampstead Road, at the same season in the following year.

73. *Macromerus* (sp. nov.?). Flew into the house at Content, during the evening, near the end of May.

74. *Lachnopus aurifer.* This beautiful insect occurred only in the neighbourhood of Kingston Harbour. At the end of June and beginning of July, my lad Sam found it in considerable num-

bers on the bushes and trees of Greenwich, the residence of J. Parry, Esq.

75. *Lachnopus* (sp. nov.). Taken near Content rather late in May.

76. *Loncophorus* (sp. nov. ?). Taken on the Hampstead Road in June.

77. *Loncophorus* (sp. nov. ?). Taken at the same place and season as the preceding.

78. *Heilipus* (sp. near *elegans*). Hampstead Road in June.

79. *Polydrusus* (sp. nov.). Very numerous on the Hampstead Road in May and June; chiefly on the leaves of a spinous-leafed *Solanum*.

80 to 83. *Cryptorhynchus*. Four species.

84. *Sphenophorus sericeus*.

85 to 87. *Sitophilus*. Three species.

88. *Calandra* (sp. near *abbreviata*).

89. *Bostrichus* (sp. near *typographicus*). The only occasion on which I met with this species was on the dissection of a *Chordeiles Virginianus* early in May. The stomach was distended with these little beetles, to the number of about two hundred, so that when turned out, one wondered how they could ever have been compressed into so small a cavity. Doubtless this bird had found a swarm of these beetles flying high in air, in the evening; for it was soon after sunset that it was shot.

90. *Stenodontes* (*damicornis* ?). Three or four specimens of this Longicorn, the female of which is the largest beetle I found in Jamaica, occurred in March, April and October. All were taken either within or about the house at Bluefields.

91. *Solenoptera fuliginosa* (Fabr.).

92. *Solenoptera lineata* (Linn.). I suspect that these two are but one species, of which the former, destitute of the white bands, is the male. Though I never found it myself, considerable numbers were given me at various times in May and June, all of which were taken at Shrewsbury, a little below Content. The sexes, if such they are, occurred in nearly equal numbers, and were almost invariably found together.

93. *Chlorida festiva*. Found within the house at Bluefields, after nightfall, about the middle of May.

94. *Eburia 4-maculata*.

95. *Eburia* (sp. near *4-maculata*).

96. *Eburia maculosa*.

97. *Eburia* (sp. nov.).

All these species occurred principally on the Hampstead Road in June, occasionally also at Sabito, and on Bluefields Mountain. I could not call either of them common, with the exception of *E. maculosa*, which, in the localities and at the season just named,

was by far the most abundant coleopterous insect I met with. It is not at all gregarious, but single individuals are seen resting on the leaves of trees that overhang the sides of the roads; scarcely a shrub being without several for miles together.

98. *Elaphidion spinicorne.* From the creaking sound made by this species in common with many others of the *Longicornes,* it is commonly known by the name of the Fiddler. It is one of those species whose activity is not confined to any particular season or locality, but is a common visitor at all times, flying in at open windows, and crawling around the candle-shades, or up the walls, in the evening. The spinous processes of the antennæ and of other parts are so long and sharp that they pierce the fingers when the insect is handled, though ever so tenderly.

99. *Elaphidion 6-fasciatum.* Very common on the leaves of low trees by the sides of the Hampstead Road throughout June.

100. *Elaphidion bidens?* Rare: a specimen taken at the Hampstead Road near the end of June.

101 to 104. *Elaphidion* (sp. near *insulare*). And three other species; occurring sparingly in June, on the Hampstead Road, and occasionally flying in at the open window at Content, in the evening.

105. *Callichroma virens.* Of this magnificent insect, which I have taken also in Alabama (U.S.), two specimens occurred in Jamaica, both of them much larger and finer than my American specimen. The first was taken resting on a projecting twig of a tree overhanging the Hampstead Road, June 24th, pretty high up. The other was brought me from the woods behind Bluefields, on the 18th July. Both were strongly fragrant during life.

[To be continued.]

XL.—*On the* Ventriculidæ *of the Chalk; their classification.* By J. Toulmin Smith, Esq.

[Concluded from p. 295.]

Genus Brachiolites.

Character. Shape and size very various, but always much lobated or branched: internal cavities of lobes and branches always communicating: extremities closed or open: membrane forming the wall sometimes plain sometimes folded: margin of wall thinned or rounded off to an edge: membrane of wall polypiferous on both external and internal surfaces.

Departing altogether from the forms hitherto examined, the present genus is characterized by its lobated or branched divi-

sions*. These divisions communicate internally, either by opening directly into each other, or by opening into a central cavity which they surround.

This genus therefore presents the Ventriculidæ in a new light. With far less of the intricate complexity of fold of membrane which is found in the other genera, it exhibits what may, in contradistinction, be called a *convolution* of membrane varying greatly in different species. And that this "convolution" is a distinct thing from the "fold" already noticed will be evident, should its essential distinctness be not otherwise recognized, from the fact that several species have the fold as well as the convolution. In the descriptions which follow, the fold and the convolution will be distinguished as the *primary* and the *brachial* fold.

This genus, like each of the others, will be found to have all its modifications adapted for the purpose of maintaining strength and stability of form and the free access of sea-water. We shall find some contrivances for these purposes of singular novelty and beauty; and it is upon the marked distinction of two groups in one general arrangement for ensuring to the whole polypiferous surface a full and constant supply of the grand element of the existence of the creatures that the sectional division of the genus is founded;—the one section having the separate lobes of such size, or so arranged with reference to a central cavity, that one main† entrance afforded sufficient access to the sea-water; those lobes in the other being so extended, or so arranged with reference to each other, that additional means were needful for that end.

The roots do not, in general, differ in this genus from the same part in the others; but I shall have occasion to call attention to some special and very remarkable contrivances in the arrangement of this part.

The forms are all well-defined; and though, like *Ventriculites*, specimens of such species as are not of great rarity are found of various sizes, there is little danger of confounding any two of the species unless in a very fragmentary state. As to the question of growth, the present genus may be considered, from the fact just mentioned, to stand on the same ground as the genus *Ventriculites*.

Different forms of this genus are found in the Upper, the Middle, and the Lower Chalk, and even in still lower beds of the

* See pp. 46, 206 *note* ‡, and 293.

† The very beautiful arrangement of *B. angularis* will be found to be one of those interesting apparent (at first sight) exceptions which prove a rule, the main access being through the central cavity, and the lateral perforations ensuring only the full and free *circulation* of the water entering, by that main access, the cavities of the arms. The contrivance in all the group *Aperti* is of a very different character. See *post*, p. 361.

cretaceous series. I believe only one, *B. digitatus**, is strictly common to all the beds, and that undergoes a modification of character in the lower ones. Some of the most marked forms are, as far as present observation has extended, peculiar to the lower of these beds.

§ *a. Operti.*

Brachial folds closed at extremity.

1. *Brachiolites tuberosus.* Pl. XV. fig. 3.

Membrane having an irregular and generally slight primary fold: brachial fold arranged subspirally around a wide central cavity, and at rather distant intervals, in tuberous sacs, broad and flattened at the head, with slight depressions in the middle of the head.

Of this remarkable species I am fortunate in possessing four well-marked specimens, all of which were found by myself, though in very distant parts of the country, and they are the only specimens I have ever seen. The form is striking. Rising from, apparently, a very short root, it attains a considerable height, one of my specimens being upwards of three inches high. The sacs usually project about four lines from the central cylinder, and are about four lines wide, though sometimes more, at their broadest part. They open by a broad and trumpet-shaped mouth into the central cavity, which is wide and open at the top. Thus the access of sea-water is freely maintained.

A transverse section gives the accompanying figure, which will be at once distinguished from that seen in a similar section (see fig. G, p. 289) of *Cephalites capitatus* or of any other of that genus.

Fig. M.

The figure (3. Pl. XV.), which is from a specimen carefully developed from the chalk by means of the needle, gives a complete idea of the species. A large part is broken away, and thus the inside, as well as the outside, is cleared out and displayed. Being, however, developed by this means, and the specimen being one in which the oxide of iron very greatly abounds, the primary fold is hardly to be seen. A careful comparison of this with other specimens shows that that fold was, like that of *Ventriculites impressus*, irregular; usually slight; but occasionally deep, at any rate in that part of the membrane which forms the central cylinder.

The remark already made, in describing *Cephalites campanu-*

* See Ann. and Mag. Nat. Hist. vol. xx. 1st Ser. p. 337, and *ante* p. 38.

latus, as to observations upon the processes, applies equally to every species of the present genus. Enough, however, can be detected to determine the fact of their presence.

This species must, in its recent state, have been singularly striking. It is difficult, indeed, to conceive anything more beautiful than must have been its exterior with each of its regularly ranged lobes covered with its myriads of living polyps and their ever-active tentacles.

All my specimens are from the Upper Chalk.

2. *Brachiolites elegans*. Pl. XV. fig. 4.

Membrane simple and without any primary fold: brachial fold beginning almost at the acute base, and rapidly increasing in broad and swelling lobes closely arranged round a central cavity, and terminating in a simple and regular crown, open at the top, and which, rising from the midst, reaches to a considerable distance above the highest lobes, and is of about half the diameter of the whole body.

This form is, in its fossil state, frequently so beautiful that I have hence chosen its specific name. The effect is heightened by the fact that the root of this species is usually long, and often maintains the same diameter for a height of nearly two inches.

The primary membrane is exactly similar to that of *Ventriculites simplex*: the brachial folds are deep and broad, their inner surface being freely exposed to access of sea-water from the large internal cavity. The crown is one of the most remarkable features of this species. It is regular and plain; springs from the lower edge of the most deeply folded lobes, and rises, unbroken, to a clear and even margin. A glance at fig. H, p. 291, illustrative of the fold of *Cephalites campanulatus*, will aid in understanding the anatomy of the present species; broad convolutions here replacing the plaits seen in that specimen, and the crown being always straight-sided, and never, I believe, assuming a funnel form. Nothing can show more convincingly than this peculiar crown, that the forms of the Ventriculidæ are not merely arbitrary massings of an amorphous or simply cumulative organism, or mere examples of "vegetative repetition," but that there was a type appointed to each which it should attain, and each having its special adaptations. In perfect specimens this head is never wanting, though it is rarely, if ever, to be seen without the aid of the knife; whence it is that it has never, so far as I am aware, been heretofore observed.

The species appears to be characteristic of the Upper Chalk.

3. *Brachiolites convolutus*. Pl. XV. fig. 5.

Membrane coarse in texture, simple and without any primary

fold: brachial fold developed very rapidly from the base, in broad and deeply undulating convolutions, so deep as to leave no regular central cavity; most prominent surfaces much flattened, and spread laterally till those of adjoining convolutions meet and unite in many places, often presenting, towards the lower part of the whole, a continuous surface.

This species displays many peculiarities. The structure of its simple membrane seems coarse, that is, the squares are larger than in any other species of the Ventriculidæ. The root is exceedingly short. The most curious point, however, is the union of the flattened prominences of the convolutions. A reference to fig. M, p. 354, will show, in *B. tuberosus,* a disposition to flattening of the most prominent part of the convolution in that species, and will make the nature of the present fold easily understood, where that flattening is so much more extensive that adjoining convolutions meet and unite*. This peculiarity was important in the present species on account of the great depth of the convolutions, which would, without it, have been more liable than in *B. elegans* and other species to be displaced, and so injury to have happened to the polyps. But a curious phænomenon is often presented in consequence. The flint,—which, from its specific gravity, would always lie, when fluid, near the sea-bottom,—was attracted round the base of the specimen, but, the surface there being usually continuous for a considerable distance, access to the lower part of the inside seldom took place, unless the siliceous fluid was very abundant; any silex attracted towards the inside† in the manner before suggested (p. 85) being specially attracted by the convolutions interposing before it reached the base, solidifying there, and thus preventing the flow of other fluid towards the base. Hence, on the decay of the animal matter, a large hollow was frequently left in the flint, which is often now found only partially filled up by chalcedony. Such flints are cup-shaped, very regularly rounded below, and have a flat top. Near the edge of that top a continuous line is usually found, showing the place of the united membrane. Within this are seen traces of the convolutions of the

* This outer surface, where the polyp-skin is preserved, which very rarely happens, may sometimes appear as if apolypous. A very careful comparison of all the specimens I have on which remains of this membrane are found, leads me, however, to the conclusion that this is not the fact; but that, the membrane being coarser than usual, the polyp-cells, though present, are not so clearly preserved as in some other species.

† The access of the liquid chalk was often made equally difficult by the collapsion, after death, of some of the lower convolutions on one another. Hence we find the bases of specimens enveloped in that substance often hollow like those in flint. Some deposit of chalcedony has often taken place in those hollows, as in the hollows of the flints.

brachial fold which attracted and retained the siliceous fluid in its descent towards the base. Fig. N is a small specimen of this kind, instances which are not uncommon in some places.

Fig. N.

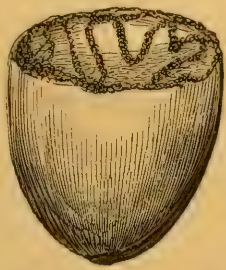


Fig. 5. Pl. XV. represents a specimen which has been longitudinally divided, and has afterwards had the convolutions cleared out by the needle. The white central parts, round the entire edges of which the structure is seen, are the only parts where the true central cavity is cut, notwithstanding the section. The depth of the convolutions will be clearly seen. It will also be observed that there are several places where the flattened convolutions do not unite, thus leaving ample means for the free admission of sea-water to bathe the whole inner portion of what is really the external surface of the membrane, though so much surrounded by the overspreading flattened, and thus actually outer, surface. The true inner surface is bathed by means of the access of water through the upper part in the usual way.

Specimens vary greatly in size. I have them from an inch to at least eight inches in height. The height to which the flattened outer surface is continuous varies in different specimens, being, as might be anticipated, greater in large ones. It is sometimes much greater on one side than on the other, a circumstance, however, which, in the living creature, would not at all interfere with the free access of the sea-water, inasmuch as the communication was free all around within and under this expanded continuous surface.

The species is found both in Upper and Middle Chalk.

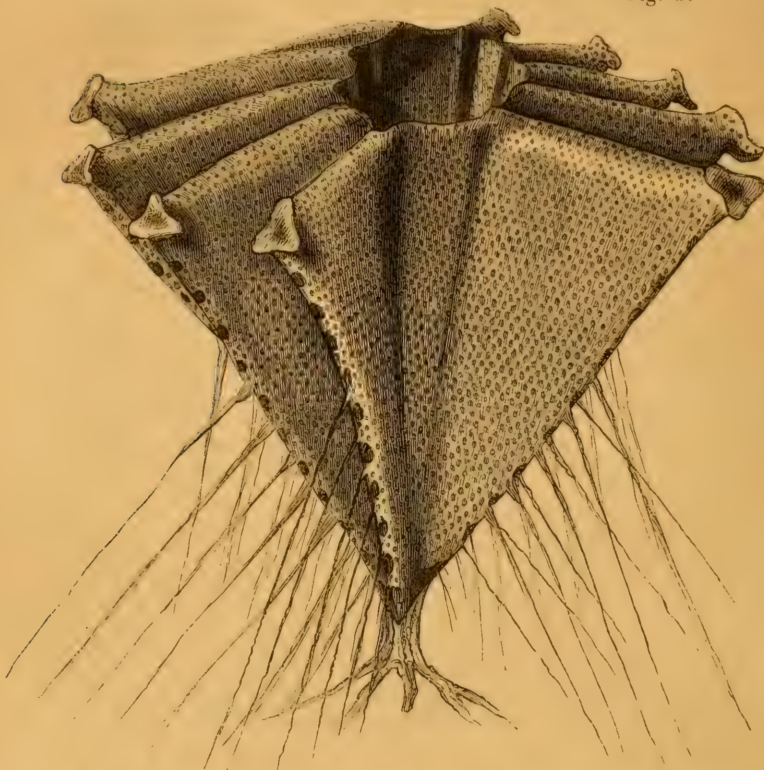
4. *Brachiolites angularis.*

Membrane exceedingly fine in texture, having a primary fold of minute and corresponding depressions arranged in more or less exact quincuncial figure: brachial fold expanding very rapidly into a varying number of arms opening into a central open cavity; each arm having the two walls parallel and flat; closed at upper and lateral edges; terminating at the external angle in a broad triangular lip depressed in the middle; and having at regular intervals, along its lateral edge, complete perforations, between which distinct and single root-fibres are attached to the membrane at intervals from the base upwards.

This is certainly the most extraordinary and interesting of the whole family of Ventriculidæ. It presents some points of such

remarkable structure as must excite the astonishment and admiration of every earnest inquirer.

Fig. O.

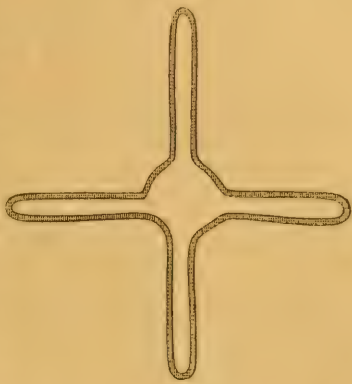


Few fossils have given rise to more varied conjecture than this. A fragment of a specimen found in an unusual condition by Dr. Mantell was originally figured by him under the name of *Ventriculites quadrangularis*. He subsequently abandoned that view,—showing that it had been adopted without the guide of any definite principle,—and, for what reason it is difficult to imagine, and none is stated, placed it among *Flustræ**. Others have amused themselves by discovering analogies to the foliaceous sponges. Remains both in chalk and flint, which had apparently escaped Dr. Mantell's notice, or whose connexion with his figured specimens was at any rate not perceived by him, have even been placed by collectors among the *Asteriæ*.

The form in which the species is necessarily most usually found

* Ante, p. 74, *note**.

Fig. P.



is seen in the accompanying figure. This can, in itself, give little idea of the form or nature of the recent animal. I have a specimen of this aspect nine inches across. Anxious to ascertain the true nature of this remarkable appearance, of which no explanation had ever been even offered, I carefully collected every fragment I could find, until I was led to infer a relation between certain flat and unconnected surfaces, sometimes found, and these markings. I was fortunate at length in obtaining two specimens, each of very large size, and which exhibited on one end the aspect of fig. P, and on the broad side, and in continuous connexion with one of the lines of that peculiar marking, an entire and unbroken surface of many square inches in extent. It became obvious that the inference already made had been correct*; that these markings were caused by the transverse section of a membrane very deeply folded up. I then had recourse, as in other cases, to dissection, in order to ascertain the entire form and habit of the creature, which no specimen developed in the ordinary way could ever show. The extreme fineness of the membrane, and the great depth of the brachial fold, made the task a very difficult one. Having, however, succeeded in several instances, I have been able to restore, from specimens thus cleared out, the beautiful and extraordinary form seen in figure O, a form of animal life seldom if ever exceeded in beauty and striking evidence of design and adaptation†.

The wall of this species is exceedingly thin and delicate, the

* These specimens had been shown by me to several friends, and my inference of the habit of the animal, with a model in paper of what I conceived its form to be, explained to them long before the importation of the 11th livraison of Michelin's 'Iconographie Zoophytologique' (see ante, p. 80). Plate 30 of that work became an interesting illustration of the present species, though giving little idea of its true character, and none whatever of its habit, on neither of which points do the accompanying descriptions afford any real aid. The character of the surface is there very imperfectly represented, and the magnified views are not truthful, which they could hardly be since that author had no idea of the true structure of this class of fossils.

† This figure, as well as all the other woodcuts illustrative of the present subject, has been executed, with great care and faithfulness, by Mr. Frederick Gyde.

squares being smaller than in any other species of the Ventriculidæ. Its membrane is folded up in very small depressions, after the manner of *Ventriculites quincuncialis,* but very much smaller, each depression being rarely more than the sixth of a line in diameter, often less, and usually of an oval form. The plaits may generally be easily traced, as, though these folds assume a quincuncial arrangement, it is usually easy, on a large surface, to trace the fan-like expansion of certain lines,—the lines of the typical plait. The squares being smaller than in other species of Ventriculidæ, the whole thickness of the folded membrane does not exceed the twentieth of an inch. The two surfaces correspond as in the section *Simplices* of the genus *Ventriculites.*

Rising from a short and, comparatively to the whole size of the animal, small central root, the fold is sometimes found for a short distance assuming a tubular form, but it generally puts on, very speedily, its characteristic brachial fold into narrow flat triangular arms. These folds vary greatly in number. The specimen above figured has ten arms, but that number is very uncommon. I have even specimens with only two, but I consider them as abnormal. The arms do not always, though generally, start from exactly the same point. This is the case with the arm on the right of the above figure, as well as with some others the bases of which cannot be seen in the present position of that figure.

Spreading out, sometimes to a very great, sometimes to a very small size, the angular fold terminates, at the top, not in double parallel edges as might have been anticipated, but with the edges united and rounded over as at the lateral margin. Each arm is thus closed on all sides except where it communicates with the central cavity, which is, normally, open at the top. The upper and lateral margins of each arm consequently form with each other an acute angle. Those margins are usually straight; those at the top being also often horizontal, and those at the sides sloping regularly down from their extremity to a point at the base. Instances are found, however, in which these margins have a symmetrical wavy outline. At the extreme outer angle of each arm there is further added a curious triangular expansion, not unlike the expansion at the extremity of each sac of *B. tuberosus.* This lip, as it may be termed, and which, like all the elevations on *Ventriculites mammillaris, B. tuberosus,* &c., is hollow within, is concave at the aspect towards the spectator.

It will be understood from this that, between the two walls of each lobe, there is an open space, narrow and of even width throughout. The communication between the central cavity and these arms being therefore not wide, though continuous, the extent and narrowness of these arms struck me for a long time as

likely to offer some difficulty in the way of the free circulation of the sea-water. Confident however that, if my interpretation of the nature of these animals were correct, the means of free circulation must exist and might be discovered, I resumed the examination with an increased series of specimens. The result was the strengthening of all conclusions as to the physiology of the whole family in general, and of this species in particular, by the discovery of a contrivance by which this end was perfectly effected; a contrivance which, for its novelty and simplicity, may well claim the inquirer's attention.

Equidistant, or nearly so, along each *lateral* margin, I found what at first I took for a larger form of depression, but which, on dissection, I found to be actual perforations* through the membrane. These are found present from near the root to the extreme angular expansion already named. A comparison of many specimens satisfied me that these perforations are never absent; that they are always ranged in the same way, and that their size is proportioned to that of the entire animal and to the width between the walls of the arms. They are usually circular, sometimes oval. They vary from half a line to two lines in longest diameter, seldom however attaining this last size.

It became at once evident that this simple provision could have but one end; but that that end it would fully effect. That end was the fulfilling of the very purpose whose incompleteness had before been felt. A constant access and circulation of sea-water would be maintained over all the inner surfaces of these lobes, deep and narrow as they are; the water, admitted at the opening of the great central cavity, coursing out, by the continual action of numberless ciliated tentacles, through these marginal perforations. And herein it is that these perforations differ from those in the group *Aperti,* and do not bring this species within that group. The large central opening was amply sufficient, in this case, for the admission of sea-water, but the peculiar form of the arms interposed difficulties in the way of its free change and circulation, which is equally necessary to the well-being of these creatures. Hence this beautifully simple contrivance for the water, admitted by the central orifice, to pass out through these perforations. In the group *Aperti,* on the other hand, each perforated lobe offered the principal, if not in every case the only, means of both access and circulation of the

* In some of Michelin's figures traces of some of these are found, which, when their nature is known, will be recognized, but which, as they appear in those figures, suggest nothing but irregular depressions: they attracted, indeed, no attention of that author, but, in his descriptions, they are wholly unnoticed, the margins being only said to be,—in the same words as the "superficiebus laminum,"—"*perforatis,*" which, as applied, is erroneous.

sea-water, just as in any single specimen of *Ventriculites* or *Cephalites*.

But the contrivances in this species to secure the well-being of the myriads of its tenants, and so strikingly indicative of design and adaptation, do not end here. Thin and delicate as the wall is, though greatly strengthened by the fact of the upper as well as the lateral margins of each lobe being closed, the currents, small as they would be, caused by the streams continually pouring out of these lateral perforations, or lungs as they may well be called, might tend to displace the form;—a matter of peculiar danger in species having such extended surfaces in such close apposition, their distance seldom exceeding one line. Besides this, such broad flat surfaces as the lobes or arms here take would offer so much resistance to the slightest impulse that the walls would be more liable than those of other species to suffer displacement; while there is no membrane, as in *Cephalites*, stretching across and attached to each to secure them in position; a contrivance indeed which, though so admirably adapted to all cases in which it is found, the length and depth and entire distinctness of the arms would, in this case, have rendered but very imperfectly effectual.

To secure the animal against such dangers I have further found that, while the central root* is comparatively small, merely acting as an anchor, there depended a single root-fibril from between each of these perforations to a considerable height†, on all sides of the entire animal. By these then was it maintained securely in shape and in position. These depending fibrils acted exactly like the

* In an earlier page, 91, contrasting the *Actiniæ*, which are locomotive, with the *Pennatulidæ*, which are, according to the better opinion, not so, but which are permanently fixed in the soft mud, I suggested that the Ventriculidæ might possibly combine both these qualities, and have a locomotive power, fixing themselves firmly, during pleasure, in the soft mud. However difficult it may be to arrive at certainty on such a point, the inquirer will probably be inclined to acquiesce in the doubtfulness with which this suggestion was offered, after considering the very peculiar arrangement of roots in the present species. The roots of this family of compound animals fulfilled the same purpose as the peduncle of the *Terebratula*. They differ indeed in structure from the latter,—for the opportunity of examining which, in the recent state, I am again indebted to the kindness of Prof. Owen,—but, in this respect, the *byssus* of the *Pinna*, with an analogous function, differs yet again from both. But it is a curious and important fact that the roots of Ventriculidæ are never found attached to rock or shells, though shells are often *attached to* parts of the surface of the body and roots: nor have the minutest shells ever penetrated the substance of the body, as they continually do in sponges.

† How high it is almost impossible to ascertain. It has been with the greatest difficulty that I have ascertained the fact at all, as it is only by following the small fibril with the knife that its presence can be detected or its direction traced.

ropes of a tent, by which alone it is securely kept in a position which, swinging on its single central support, it could not otherwise sustain for an instant*.

Such are the normal characters of this very curious and interesting species. As was to be expected in so delicate a species, specimens are, not unfrequently, found exhibiting abnormal forms; owing either to displacements of the dead mass before or during the process of fossilization; or, sometimes, to incomplete development of the living mass, or accidents to the living animal,—accidents to which, from its delicacy and remarkable form, it would be peculiarly liable. Thus I have a flint ten inches in length covered with irregular markings, but in which may I think be clearly traced displaced portions of an individual of this species. I have similar specimens in chalk in which it appears clear that the originally flat arms have been tumbled and bent over upon one another in confusion. I have myself collected more than one specimen which would seem never to have had more than two of the flattened arms. In such cases compensating provisions are found; and, there being no large central cavity, the lateral perforations are found larger than usual, and on both edges of what thus becomes one elongated double fold. I have another most interesting specimen, in which the opening of the central cavity is in an abnormal position, namely on one side; but still it is there present in all its completeness, thus showing the necessity and the presence of some compensation where any abnormal conditions exist. There is, indeed, no species among the Ventriculidæ which bears more conclusive evidence to the truth of the views heretofore expressed as to the character, affinities, and habits of the recent animal than does *Brachiolites angularis*.

I cannot conclude the account of this species without expressing the strong feeling which its examination impresses of the wonderful variety, and always completeness, of the contrivances by which nature has effected her ever-present purpose of securing the well-being and permanent safety of every creature she has made. The theorists on *mere*† "*Vegetative Repetition*" and on "*Progressive Development*" will find themselves equally at fault in the examination of this species. There is no form which the naturalist can study with greater interest, admiration and instruction than that of *Brachiolites angularis*.

This species is found in both Upper and Middle Chalk.

* The reader will recal the description of an abnormal form of root already given (p. 92). That specimen is of the genus *Ventriculites*. What is there abnormal becomes a special character in the present species.

† This word is used advisedly, to distinguish those who thus theorize from those who philosophically inquire into the important questions of *serial homologies*.

§ *b. Aperti.*

Brachial folds open at extremity.

1. *Brachiolites foliaceus.* Pl. XVI. fig. 1.

Membrane simple and without any primary fold: brachial fold variously winding and irregularly anastomosing, and thus forming irregular but close and connected sinuous cavities, with rounded, but irregularly arranged, external openings: mass rising to a considerable height; expanding slowly from root, and the whole maintaining, throughout, a narrow diameter.

The style of fold of this delicate species is very similar to that of the recent *Eschara foliacea.* The form assumed by the whole mass differs however materially. Instead of spreading horizontally, the habit of *B. foliaceus* was to rise perpendicularly. It sometimes attained six inches in height, but seldom more than an inch in width at its broadest part. The external openings in this species also differed materially; those openings being usually separate. and circular or oval in form, not irregularly running into each other as in *E. foliacea.*

Fragmentary portions in flint or chalk may readily be distinguished from those of any preceding species by the greater delicacy of the membrane and closeness of the brachial fold. The upper part of fig. 1. Pl. XVI. shows the appearance displayed on a vertical section; while the lower part of that figure shows the external appearance of the fossil when entire.

The close anastomosing of the brachial folds of this species must have given great strength to the whole body; while the freely communicating cavities would allow constant access and circulation of the sea-water.

I have a specimen in which the whole animal part is converted into iron pyrites and the cavities are perfectly clear of all matrix.

The species is found in Upper and Middle Chalk.

2. *Brachiolites racemosus.* Pl. XV. fig. 6.

Membrane having a rather deep primary fold, round, and of nearly equal width the whole depth of the fold, and arranged in quincuncial figure: brachial fold beginning at some distance from the base, and running in narrow and short but regular cylinders ranged subspirally round a small central cavity at rather distant intervals.

This species differs essentially from the last in having a deep primary fold; in having a distinct central cavity, though varying in size, into which each of the brachial folds opens; and in these

last being distinct*, and regular in form and arrangement. The term *racemosus* seems peculiarly expressive of the character of this species. The perfect animal rose on a rather high stem. I am fortunate in possessing a specimen in flint, from which the fig. 6 on Pl. XV. is drawn, with the stem and roots entire, a condition in which the members of the present section are very rarely found. I have another specimen in which the processes are very conspicuously seen, also an exceedingly rare circumstance in specimens of this genus.

The wall of the brachial fold is full a line in thickness, often more, owing to the depth of the primary fold, which much resembles that of *Ventriculites quincuncialis.* The central cavity is usually very small, the access of sea-water being abundant, and its circulation free, by means of the open short cylinders which the brachial fold assumes. Occasionally the central cavity is wide however; though the opening into it is not, even then, proportionably wide, a fact which might have been anticipated.

It would be difficult to confound this species with *B. tuberosus,* though the general habit is the same. The primary fold, and the nature of the lobes, open at the extremity, and much larger than those of *B. tuberosus,* at once distinguish the two†.

All the specimens which I have seen of this species are from the Upper Chalk.

3. *Brachiolites digitatus.* Pl. XVI. fig. 2.

Membrane having a deep primary fold of regular quadrilateral and rectangular form, usually more or less oblong, and arranged in tessellated figure: brachial fold branching out irregularly

* I have observed, in one specimen in flint, an indistinct appearance as if two of the cylinders adjoined at one point. If it be a true anastomosis (which I doubt), it is a very rare exception. No symptom of it has been seen in any other instance.

† Through the kindness of Mr. Wetherell I am in possession of one very interesting specimen of this species, strikingly illustrative of the truth of the views expressed in the early pages of these sheets as to the peculiar state in which silicified specimens are found. Each of the cylinders is separately encased in a thin coat of flint, so that the whole was actually taken, by a distinguished palæontologist, for the silicified fruit of a *conifer.* In touching on this subject I cannot forbear citing a passage from Humboldt's 'Cosmos,' published long after my remarks on the formation of flint and on the silicified Ventriculites were written, and which is in direct accordance with, and therefore supports, the views advanced by me on both those subjects. That writer alludes to the siliceous-shelled infusoria as being universally found in sea-water, "*although* the chemical analysis of sea-water has not shown *silica* to be one of its essential constituents; and *it could only indeed exist in water in a state of simple mixture or suspension.*" (Vol. i. p. 341.) This, however, is a state of things which Mr. Bowerbank has expressed himself unable, "by any stretch of the imagination," to "conceive." 'Ann. and Mag. Nat. Hist.' vol. xix. 1st Ser. p. 260.

into long and wide regular cylinders either grouped near the base or dividing off one from the other.

This species differs most essentially from the last. Both primary and brachial fold altogether differ. The former exactly resembles the fold of *Ventriculites tessellatus*. The latter is very peculiar. It often displays a group of cylinders radiating out from near the base just like the outstretched fingers of the hand; and the length and thickness of the cylinders increase the resemblance. Hence the name. It is often found however under a modification of this form, rising to a considerable height, and one branch rising out of the other, at considerable distances, as it increases. In each case alike the cylindrical cavities of all the branches open into each other, and there is no true separate central cavity into which they open. The separate branches form exceedingly regular cylinders, and the primary fold is marked on each with perfect regularity. The margin goes off to a round edge, as will be seen in the figure.

The species cannot be at all understood, or even detected, without careful clearing out with the knife and needle; since its very nature, like that of every other species in this section, prevents it ever coming out of the matrix entire by any accidental fracture: beautiful fragments of it are, however, sometimes found.

The species is found in the Upper and Middle Chalk. A form essentially the same and of the same habit is sometimes found in the lower chalk and in the chalk marl and greensand*. In all the specimens from these latter beds which I have seen the thickness of the wall is however much greater, and the diameter of the branches also rather greater than in specimens from the Upper and Middle Chalk, a fact which it is interesting and important to notice as connected with the stratigraphical distribution of these fossils, though I do not conceive these minor characters sufficient to justify, at present at any rate, and until their constancy is fully established, a distinct species or even variety for those lower forms.

Among the Mount Rhanden specimens in the British Museum are individuals identical in general character and habit with the last-named modification of *B. digitatus*.

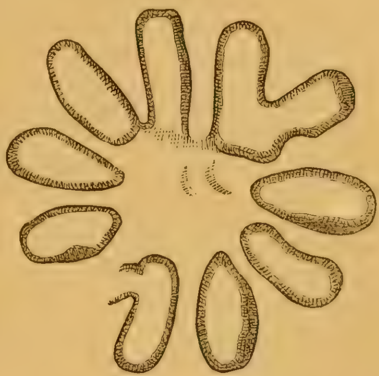
4. *Brachiolites tubulatus*. Pl. XV. fig. 7.

Membrane having a more or less slight, but close, primary fold, without any regular figure: brachial fold in narrow tubes increasing in size and length from the base upwards, and closely ranged round a central cavity; each tube narrowing at the mouth.

* See ante, p. 354.

This form will readily be distinguished from every other not only by the difference in the primary fold from that of any species which approach it in the character of the brachial fold, but in the essential character of that brachial fold itself. The narrowness, in comparison with the length, and the close setting of the tubes, are together found in no other species. The accompanying figure, which is a transverse section of a specimen of this species, near the top, and just therefore missing the central cavity, could be presented by a similar section of no other species. It seems to me that there is generally no marked distinct opening to the central cavity, but that it is surrounded on all sides by the tubes. In fig. 7 of Pl. XV. the upper part was cut away before it came into my possession, but the wall of the cavity is, in that specimen, rounding inwards, and not expanding.

Fig. Q.



It is important to notice that each brachial fold is distinctly tubular and prominently projecting, and that its termination is slightly contracted, in the present species, two characters in which it essentially differs from *B. labrosus* and *B. fenestratus*, and characters which must obviously have materially affected the access and circulation of the sea-water. The central cavity into which those tubes open is another character to which the last remark strongly applies, and is a character also at once distinguishing this species from *B. fenestratus*.

This species is from the Middle Chalk.

5. *Brachiolites fenestratus.* Pl. XVI. fig. 3.

Membrane simple and without any primary fold: brachial fold in narrow tubes anastomosing and opening into each other in not very regular figure, but in several vertical and horizontal planes, leaving interspaces between them about equal to their own width: each tube rounding at mouth and projecting slightly beyond the plane of the most external range of the anastomosed mass.

The description will at once show wherein this species differs from the last. A single fragment of tube may be mistaken, as the primary fold is not strikingly marked in either, and the size

of the tube is the same in each. But masses of the two cannot be confounded, and the specific distinctions, as noticed in treating of *B. tubulatus*, are very important. It should be further noticed that, in the present species, there is not that variety in the size of the tubes which, as seen in fig. 7. Pl. XV., is found in *B. tubulatus*.

A certain degree of regularity is generally found, on careful observation, in the arrangement of the anastomosing tubes; that arrangement bearing often a near resemblance to regular square lattice-work. This arrangement extends both in the horizontal and vertical plane, as endeavoured to be represented in fig. 3, Pl. XVI. Specimens sometimes attained a large size.

Both this species and the last are very beautiful fossils when they can be obtained in any degree of perfectness. This however is extremely difficult, owing to the small branching arms of which each is made up. The inquirer may, unless great care is bestowed, and very cautious dissection made, easily mistake for them some of the markings often found on accidental fracture of chalk and flint, and on the outsides of flints, and which are really caused by *B. foliaceus* or other of the sinuous species. Oblique fractures take very indeterminate forms.

This species is found in the Chalk Marl and Upper Greensand. I have never seen a specimen from any higher beds.

6. *Brachiolites labrosus*. Pl. XVI. fig. 4.

Membrane having a slight and irregular primary fold: brachial fold variously winding and irregularly anastomosing, thus forming irregular but wide sinuous cavities opening into each other, with slightly projecting wide and irregular openings having entire and rounded margins: mass compact, broad and wide; rising to a moderate height, and subglobose in form.

The description will at once enable the inquirer to distinguish this very marked form from every other. The character of the primary fold resembles that of *Ventriculites impressus*. It is not nearly so close as in *B. tubulatus*, but much closer than is usual in *B. protensus*. The mouths of the cavities rarely open, as in *B. fenestratus*, by a regular cylindrical tube, but are very often elongated or irregular, and more or less constricted near the middle. The margin, however, is in every case entire, and generally spreads outwards, thick and lip-like, whence the name. The figure exhibits these peculiarities, but the size of the plate did not allow space for the representation of an entire specimen.

This species is found in the Chalk Marl and in the Upper Greensand. I have seen it from no higher beds.

7. *Brachiolites protensus.* Pl. XVI. fig. 5.

Membrane having a slight and irregular primary fold: brachial fold in large sinuous tubular masses frequently anastomosing and opening into each other, and with occasional, but irregular, large interstices: mass very irregular and usually spreading horizontally.

This species will perhaps be best understood if the inquirer conceives a number of the arms of *B. digitatus* to be more or less contorted instead of straight, and to anastomose and open into each other instead of always being distinct from each other at all other points than their bases. The tubular folds of *B. protensus* project from the mass not very prominently, but still conspicuously and in every direction. The primary fold differs however, as will be seen both by the description and figure, most essentially from that of *B. digitatus*.

The habit of the mass is the very reverse of being compact like *B. labrosus*; it may best be described as *sprawling*, whence the name; its tendency being usually to horizontal rather than perpendicular extension: it does not seem to have any inclination to assume the globose or any other definite general figure. The mouths of the tubes tend to expand as in *B. labrosus*, while in *B. digitatus* their tendency, where not simply straight, is rather to contract as in *B. tubulatus*.

This species is from the Lower Chalk and Chalk Marl.

I have thus laid before the reader the result of an investigation which has engaged most of the leisure hours of some years. I am too conscious of the disadvantages under which I labour, and the want of qualifications which I possess, to anticipate otherwise than much criticism as to the result of that investigation and the execution of my task. I would only request the reader to remember that the field was an entirely untrodden one and the task a new one,—"a task of no little difficulty in the accomplishment, and one that may fairly entitle him who enters upon it to expect to meet with indulgence*."

I have endeavoured to show the existence, in one, at least, of the great geological epochs, of a widely extended class of animals whose nature,—if the existence of a few of the forms was vaguely known before,—was totally unknown, as also was their structure and all that constitutes the knowledge of an organic being. I have exhibited a structure as remarkable as it is novel. I have shown the extraordinary variety of forms which that structure assumes,—a variety in which one Law of Unity, however, still

* Farre, ut ante, p. 387.

prevails. Numberless illustrations of design and adaptation have forced themselves upon attention in the course of the investigation, and more might have been suggested had it not been feared that the allusion would appear obtrusive.

It cannot be supposed that the forms which have been here described constitute all that existed of this family even in the cretaceous seas. In my own collection are a few individuals as to whose specific identity I have some doubt, but as to which I would wait for further means of observation rather than rashly increase the number of species. Doubtless, now that the structure has been described, and figures and descriptions of such numerous forms been given, some attention will be directed to the subject and other forms be found. From the great extent of the materials on which these observations have been made, it may, however, without presumption, be conceived that the principal typical forms are here included, and that any which may hereafter be clearly ascertained will range themselves easily in one or other of the groups whose characters, general and special, have been here determined.

Many other obscure fossils are found in the chalk, either generally unknown or distinguished by names which impart little idea of vitality to the objects to which they have been attached,—a vitality which it is sought in vain to realize by any descriptions which have hitherto been published. To a more particular examination of some of these, the attention of such readers as have followed with any interest the present inquiry into the structure, affinities and forms of the Ventriculidæ, may, at a future day, be perhaps invited.

EXPLANATION OF PLATES.

[Plates VII. and VIII. appeared in vol. xx. of the first Series.]

Pl. VII. (all in flint except figs. 1, 2, 3, 9 and 12).

Fig. 1. Transverse section of *Cephalites longitudinalis*, pp. 89 & 281.
— 2. Transverse section of *C. alternans*, pp. 89 & 283.
— 3. Oblique section of *C. bullatus*, p. 284.
— 4. Vertical section of *Ventriculites*, showing base of body lodged and ensheathed in the root: the upper part showing the fold of the membrane, p. 88.
— 5 & 6. Vertical and transverse section of the same specimen showing body lodged and ensheathed in the root, p. 91, & see p. 362, note.
— 7. Root seen externally ensheathing body, p. 91.
— 8. Intimate structure of the Ventriculidæ highly magnified, showing square and octahedral structure, p. 93.
— 9. Cast in chalk of this structure, p. 95.
— 10. The octahedral structure very highly magnified, p. 95.
— 11. The dermis or underskin, pp. 95 & 182.
— 12. The epidermis or polyp-skin, pp. 95 & 182. This specimen is broken away at the upper part, showing traces of the structure below.

Fig. 13. The polyp-cells: vertical section highly magnified, p. 188.
— 14. The mode of addition of fibre, p. 93.

Pl. VIII. (all in chalk except fig. 7).

Figs. 4 & 5. Casts showing the places of processes, p. 184.
— 6. Polyp-cells highly magnified, p. 187.
— 7. Root-fibre encrusted with chalcedony, p. 97.
— 1. *Ventriculites simplex*, p. 204.
— 2 & 3. *Ventriculites impressus*, p. 205.
N.B. For *Ventriculites quincuncialis* see Pl. VII. fig. 7, & p. 207.

Pl. XIII. (all in chalk, except fig. 6, which is in flint).

Fig. 1. *Ventriculites muricatus*, p. 210.
— 2. *Ventriculites tessellatus*, p. 211.
— 3 & 4. Different sections of *V. tessellatus*, p. 211.
— 5. *Ventriculites cavatus*, p. 212.
— 6. *Ventriculites striatus*. p. 212.
— 7. *Ventriculites mammillaris*, p. 213.
N.B. For *Ventriculites latiplicatus* see fig. D, p. 215.
— 8. *Ventriculites decurrens*, p. 215.
— 9. Variety *tenuiplicatus*, p. 215.
— 10. *Ventriculites radiatus*, p. 218.
— 11. Section of *V. quincuncialis*, p. 208.
— 12. Section of *V. muricatus*, p. 210.
— 13. Plaits of *V. striatus*, pp. 214, 216.
— 14. Plaits of *V. mammillaris*, pp. 214, 216.
— 15. Plaits of *V. radiatus*, p. 216.
N.B. For *Ventriculites bicomplicatus* see fig. E, p. 219.

Pl. XIV. (all in chalk).

Fig. 1. *Cephalites longitudinalis*, p. 281.
— 2. *Cephalites guttatus*, p. 282.
— 3. *Cephalites paradoxus*, p. 283.
— 4 & 5. Outer and inner surfaces of *Cephalites alternans*, p. 283.
— 6. *Cephalites bullatus*, p. 284.
— 7. Section of *Cephalites bullatus*, p. 284.
— 8. *Cephalites retrusus* (moulded from a cast in flint), p. 285.
— 9. *Cephalites catenifer*, p. 286.
— 10. *Cephalites compressus*, p. 287.
— 11. *Cephalites capitatus*, p. 288.
— 12. *Cephalites campanulatus*, p. 289.
— 13. Vertical section of *Cephalites campanulatus*, p. 292.
— 14. Piece of the matrix from inside of *C. catenifer*, showing projecting parts, which filled the depressions in the living animal, broken away, p. 286.
— 15. Transverse section of fold of membrane of *C. catenifer*, p. 287.
— 16. Plaits of *C. catenifer*, p. 287.

Pl. XV. (all in chalk, except fig. 6, which is flint).

Fig. 1. *Cephalites constrictus*, p. 292.
— 2. *Cephalites perforatus*, p. 294.
— 3. *Brachiolites tuberosus*, p. 354.
— 4. *Brachiolites elegans*, p. 355.
— 5. *Brachiolites convolutus*. The specimen has been vertically divided and one-half cleared out, thus showing the convolutions and the interior, p. 355.
N.B. For *Brachiolites angularis* see fig. O, p. 357.

Fig. 6. *Brachiolites racemosus*: the right-hand portion shows the form of the arms as seen on outside of flint; the left-hand portion shows the root and longitudinal sections of several arms, p. 364.
— 7. *Brachiolites tubulatus*, p. 366.

Pl. XVI. (all in chalk).

Fig. 1. *Brachiolites foliaceus*: the lower part showing the outside, the upper part a vertical section, p. 364.
— 2. *Brachiolites digitatus*, p. 365.
— 3. *Brachiolites fenestratus*, p. 367.
— 4. *Brachiolites labrosus*, p. 368.
— 5. *Brachiolites protensus*, p. 369.

XLI.—*Remarks on the Migrations of* Aphides. By Francis Walker, F.L.S.

From the great Author all that lives
Its stated boon of life receives.
Ere long again restored to thee;
Each insect too minute to name
Yet owns a portion of thy flame,
Part of thy numerous family.

Resplendent cars of fiery glow
From realms of light to earth below
Thy animated offspring bear;
And when this mortal trial ends,
Again the glorious car attends
To wing them to their native sphere.

Lorenzo de Medici.

In the following notice I have enumerated some of the species of Aphis that migrate at regular periods from one kind of plant to another, or whose food has been partly altered by the cultivation of plants. *Aphis Rosæ* migrates from the rose to the teazel; *A. dirhoda* from the rose to grasses and flags, and the introduction and growth of corn have afforded it a new nourishment, and have consequently modified its habits; and the cultivation of various species of rose brought into this country has also increased its food, and that of *A. Rosæ* and of the three following species: *A. trirhoda* migrates from the rose to the columbine, and this change of food is probably not aboriginal, but consequent on the cultivation of the latter plant. *A. tetrarhoda* and *A. Rosarum* appear to live only on the rose genus. *A. Avenæ* has its first habitation on grasses, and the cultivation of corn has furnished it with a new and abundant source of food. *A. Capreæ* migrates from the willow to umbelliferous plants, and in this case both the winter residence and the summer pasture of the species are aboriginal. The food of *A. Urticaria* is divided between the nettle and the bramble, and both these plants are also original sources. *A. Humuli* lives permanently and aboriginally on the

sloe, and the hop-grounds now provide it with a plentiful provision in the summer. Its presence on the hop is dependent on the proximity of the sloe to the hop-grounds, and these plantations should be inspected, and the extent of the sloes in the vicinity and their distance from the hops ascertained, and the length of the flight of the Aphis should also be observed, in order that the hop and the sloe may in time be kept sufficiently remote from each other to confine the Aphis to the latter plant and thus to prevent its injuring the hop. *A. Ulmariæ* dwells on the broom, and the meadow-sweet is its summer food, and the cultivation of sweet peas, peas, beans, clover, tares, vetches, saintfoin, &c. has added greatly to its means of subsistence. *A. Lactucæ* is very abundant on the sow-thistle and some allied plants, and its œconomy is modified by the presence of the lettuce and the black currant in gardens, to both which plants it is very partial. *A. Brassicæ* feeds especially on the sea-kale in a wild state, and also on the wild mustard, and the introduction of the cabbage from the South of Europe has added to its food in this country. *A. Pruni* has settled on the plum since that tree was brought into Europe, and it has received the name of *A. Arundinis* from its feeding on the reed, which is its earliest habitation. *A. Mali* and *A. Sorbi* dwell on the white-thorn as well as on the apple, the service, the medlar and the mountain-ash. *A. Persicæ* is so named from its having fixed itself on the peach since that tree was planted in Europe, but its other name, *A. Prunicola,* denotes its primitive habitation and food. *A. Juglandis* and *A. Juglandicola* have accompanied or followed the walnut in its successive cultivation westward from Persia, which is its native country, and that of the peach and of the apricot. *A. Abietina* has probably come into England with the spruce fir, and a few other species that feed on the fir-tribe may have also been brought over from the continent. *A. Rubi* abounds on the bramble and on the raspberry, and during the summer is also common on *Geum urbanum,* the common Avens, and on a species of *Epilobium* or willow-herb. *A. Dianthi* (otherwise named *A. vulgaris* and *A. Rapæ* and *A. vastator*) feeds on a very great variety of green-house plants. The furze seems to be the principal winter-quarters of *A. Rumicis,* and I observed that it swarmed profusely and laid its eggs on that plant in the autumn of 1846, and the following year was remarkable on account of the devastations of this Aphis in the bean-fields; it feeds also on the laburnum, the poppy and the dock, and on very many other plants. It was unusually abundant on the laburnum last year, and great numbers of humble-bees came to feed on its honey. The lady-bird (*Coccinella 7-punctata*) was also extremely common with this Aphis, and it promises to be equally so this year, for great numbers have already appeared during March and April.

BIBLIOGRAPHICAL NOTICES.

Flore de France, par M. Grenier et M. Godron. Vol. I. Part I. Paris, 1848. 8vo.

We have much pleasure in recommending to the notice of our botanical readers this first portion of what promises to be a most valuable work. Now for the first time there is a probability of our possessing a general French flora of a truly scientific and comprehensive kind. All the former attempts at such a work have been deficient in one or other of those respects :—the best of them, although high in scientific character, is very incomplete in other points. Many large districts of France seem long to have suffered an almost total neglect from botanists, and it is only of late that the publication of good local floras, and the more general distribution through France of that botanical knowledge which was so long confined, in a great degree, to Paris, has provided the requisite materials for a complete flora.

The work before us is arranged very nearly in accordance with the system of DeCandolle as developed in his 'Prodromus'; and this first part, commencing with *Ranunculaceæ*, includes thirty Natural Orders, concluding with *Coriariæ*. The language is French; the plan similar to that of Koch's 'Synopsis Floræ Germanicæ' and Babington's 'Manual of British Botany.'

Were we to attempt a detailed examination of the contents of this work, we should extend far beyond our limits; we therefore merely remark, that the apparent tendency of the authors is to divide species rather more than seems desirable to us.

This work is as necessary to the student of British botany as Koch's 'Synopsis.' Both of them ought to be in the hands of all who aspire to a higher rank than mere collectors. We look anxiously for the continuation of this flora.

A Manual of the Botany of the Northern United States, from New England to Wisconsin and south to Ohio and Pennsylvania inclusive, arranged according to the Natural System. By A. Gray, M.D. Boston, 1848. 12mo. 710 pages.

Dr. A. Gray has here supplied botanists with a very valuable condensed account of the plants of the northern part of the United States. It includes the flowering plants and ferns by Dr. Gray himself, and the mosses and liverworts from the pen of Mr. W. S. Sullivant. Mr. John Carey has elaborated the genera *Salix*, *Populus* and *Carex*.

The plan of the book is similar to Koch's 'Synopsis Floræ Germanicæ,' and must prove as useful to the student of the plants of its province, as that work has been found to be by the botanists of Central Europe.

We need scarcely add that it is an excellent work; the name of its author is a sufficient guarantee of that being the case. It is just what was wanted by the European botanist, since, in conjunction with

Hooker's elaborate 'Flora boreali-americana,' we are now supplied with an accurate account of the plants of those parts of America in which the genera and species are most nearly allied to those of Northern Europe. It is most interesting to observe the considerable number of species which seem apparently correctly identified with those of Scandinavia and Britain, and we are much struck with the great number of European weeds which are naturalized in the United States.

It is to be hoped that, now that this work is off his hands, its author will hasten the publication of the continuation of the 'Flora of North America,' of which one complete volume and three parts of a second, extending to *Compositæ* inclusive, have appeared from his pen in conjunction with Dr. Torrey. It is now five years since the last portion of that flora was published, and we can assure its authors that it is not without great anxiety that European botanists have been long expecting its continuation.

In conclusion we can strongly recommend this Manual to all botanists. It is published in London by John Chapman.

In the Press.

We are glad to learn that Mr. Ralfs' beautiful work on that interesting tribe the *Desmidieæ,* will be ready for distribution to the Subscribers in the course of a few days.

PROCEEDINGS OF LEARNED SOCIETIES.

LINNÆAN SOCIETY.

June 1, 1847.—The Lord Bishop of Norwich, President, in the Chair.

Read a "Description of *Athalamia*, a new genus of *Marchantieæ.*" By Hugh Falconer, M.D., F.L.S. &c.

ATHALAMIA.

CHAR. GEN. *Flores masculi? Capituli fœminei receptaculum* nullum; *floribus* immediatè pedunculo insertis, erectis. *Involucrum* nullum. *Involucella* tubulosa, vertice bivalvia, basi inter se connata. *Calyptra* persistens, sub-bifido-lacerata. *Sporangium* in lacinias 4 v. 5 demùm revolutas dehiscens; pedicello elongato sub-exserto.—Frons *simplex, v. radiatim* 3-*loba, crassè carnosa, subtùs margine squamis foliaceis pluri-seriatis instructa; lobis oblongis, concavis, margine attenuatis;* pedunculo pedicellisque *crassis, succulentis, teretibus.*

ATHALAMIA PINGUIS, *Falc.*
Hab.

The absence of a common receptacle and the erect flowers appear to be the most characteristic marks of the genus *Athalamia*, which is most nearly allied to *Lunularia*, Micheli, in the dehiscence of the sporangium and elongation of the pedicel.

June 15.—The Lord Bishop of Norwich, President, in the Chair.

Read "Some Account of an undescribed Fossil Fruit." By R. Brown, Esq., D.C.L., V.P.L.S. &c. &c.

This singularly beautiful and instructive fossil, which had for many years formed part of the collection of Baron Roget in Paris, was brought to London in 1843, and purchased jointly by the British Museum, the Marquis of Northampton and Mr. Brown. Nothing is known of its origin, but from its obvious analogy in structure and mineral condition with *Lepidostrobus*, Mr. Brown conjectures it to belong to the same geological formation.

The specimen is evidently the upper half of a strobilus very gradually tapering towards the top. As brought to England it was not quite two inches in length, but a transverse slice, probably of no great thickness, had been removed from it in Paris; and the transverse diameter of the lower slices somewhat exceeded the length of the specimen. Its surface, which was evidently water-worn, is marked with closely approximated unequal-sided hexagons, which are the terminations of bracteæ, and become smaller and less distinct towards the top.

From transverse and vertical sections it appears that the strobilus is formed of a central axis of small diameter, compared with the parts proceeding from it, which consist:

1. Of bracteæ, densely approximated and much-imbricated, having their lower halves at right angles to the axis, while the imbricating portion, of equal length with the lower and forming an obtuse angle with it, is gradually thickened upwards. These form the spokes and external rhomboidal areæ seen in the transverse section.

2. Of an equal number of oblong bodies, of a lighter colour and more transparent, each of which is adnate to and connected by cellular tissue with the upper surface of the corresponding bractea. These bodies are sections of *sporangia*, filled with innumerable microscopic *sporules*, originally connected in threes, very rarely in fours, but ultimately separating. From this triple composition or union of *sporules*, which differs from the constantly quadruple union in tribes of existing plants, namely *Ophioglosseæ* and *Lycopodiaceæ*, which from other points of structure may be supposed to be most nearly related to the fossil, Mr. Brown has named it *Triplosporite*.

The structure of the axis, which is well-preserved, distinctly shows, in the arrangement of its vascular bundles, a preparation for the supply of an equal number of bracteæ. These vascular fasciculi are nearly equidistant in a tissue of moderately elongated cells. The vessels are exclusively scalariform, very closely resembling those of the recent *Ferns* and *Lycopodiaceæ*, and among fossils, those of *Psarolites*, *Lepidodendron* and its supposed fruit *Lepidostrobus*, as well as several other fossil genera, namely *Sigillaria*, *Ulodendron* and *Diploxylon*.

Mr. Brown does not propose to enter fully into the question of the affinities of *Triplosporite*; but contents himself with remark-

ing that in its scalariform vessels it agrees with all the fossil genera supposed to be *Acotyledonous*; and that in the structure of its sporangia and sporules it approaches most nearly, among recent tribes, to *Ophioglosseæ* and *Lycopodiaceæ*, and among fossils to *Lepidostrobus*, and consequently to *Lepidodendron*. The stem-structure of *Lepidodendron*, known only in *Lepidodendron Harcourtii*, offers no objection to this view, the vascular arrangement of the axis of its stem bearing a considerable resemblance to that of *Triplosporite*. To this argument, derived from the agreement between axis of stem and axis of strobilus, Mr. Brown attaches considerable importance, as an equal agreement exists both in recent and fossil *Coniferæ*.

Mr. Brown adds, that Dr. J. D. Hooker has very recently detected, in the sporangia of a species referred to *Lepidostrobus*, sporules united in threes; there still however remain, in the form and arrangement of the sporangia of that species, characters sufficient to distinguish it generically from the fossil here described.

The paper was illustrated by drawings, both of the natural size and microscopic.

Read also a note "On the occurrence of the Potatoe Disease independent of the Attacks of Insects." By J. O. Westwood, Esq., F.L.S., Secretary of the Entomological Society, &c. &c.

This note, in which the author maintained that the disease which has of late years been so destructive to the potatoe is wholly independent of the agency of insects, was illustrated by numerous recent specimens of the potatoe-plant, in which the disease had made considerable progress in the tuber, while the haulm appeared perfectly healthy; and on which the ravages of insects, and in particular of the *Aphis* to which the devastation has been so confidently attributed, were nowhere to be traced.

November 2.—E. Forster, Esq , V.P., in the Chair.

Mr. Westwood exhibited the following cases of insect monstrosities:—

1. *Chiasognathus Grantii*, with the left antenna deformed, furcate at the base of the serrated portion; one branch very short and apparently composed of four clavate joints, the other branch shorter than in the normal antenna and irregularly and shortly serrated; the lower division of the left mandible also shorter than that of the right side. From Mr. Westwood's collection.

2. A new species of *Elateridæ* from Ceylon, in Mr. Templeton's collection. The middle foot on the right side deformed; the coxa and trochanter normal, but with three femora conjoined at their bases, and emitting three perfect tibiæ, and two perfect and one imperfect tarsus.

3. An Indian *Copris* allied to *C. lunaris*, from Col. Hearsey's collection, in which the upper portion of the front of the head is wanting, exposing the parts of the mouth.

Read a paper "On the Natural History, Anatomy, and Development of *Meloë* (Third Memoir—the Anatomy)." By George Newport, Esq., F.R.S., F.L.S. &c.

Mr. Newport commenced this memoir by stating that having

traced the Natural History of *Meloë* in the preceding memoirs, he now proposed to examine its Anatomy "with reference to those principles which regulate the formation of animal bodies, and which seem to be the links of connexion that associate peculiarities of instinct with the evolution and with the functions of special structures."

The portion read was the first section of the third memoir, the *tegument* of the young larva. This structure was shown to be the primary and essential foundation-tissue of the organized being, having its origin in the *blastoderma*, and being composed entirely of cells, like the young tissue of plants. The form of the body of the embryo entirely depends on the changes which take place in this structure, and the principles which regulate these changes regulate also those of the whole life of the insect.

The growth of the tegument of the young larva Mr. Newport showed to depend on the division of the nuclei of its cells; that the subsequent consolidation of the tegument in the formation of the hardened dermo-skeleton of the insect is the result of the secretion of earthy materials by the nuclei of the tegumentary cells, in a manner similar to that in which bone is formed in the *Vertebrata*, by the calcification of the cells in layers of the surface of the periosteum, as shown by Hunter, Flourens, Goodsir, Sharpey, Tomes and others; and that this is analogous to the mode in which the woody fibre of exogenous trees is formed on the inner surface of their bark. The earthy constituents of the dermo-skeleton were stated, from the chemical analyses of Odier, Lassaigne and Mr. Children, to consist chiefly of phosphate of lime, with carbonates of potass and lime, and a little phosphate of iron, and in some species with traces of silica, magnesia and manganese; materials which, ten years ago, led Mr. Newport to describe the dermo-skeleton of insects as "an imperfectly-developed condition of bony matter," a view which has recently been much supported by the discovery by Platner of star-shaped corpuscles in the tegument of the silkworm, closely resembling those of true bone in the *Vertebrata*.

The tegument of insects is thus regarded as analogous in its mode of development, as in its function, to that of the skeleton of the Chelonian Reptiles. This structure in the very young *Meloë* was then fully described, and the nature of its appendages and functions examined. The spines and hairs were shown to originate from the centre of tegumentary cells, and were regarded as excessive developments of the nuclei as single bodies. The growth and development of the tegument was shown to be effected by means of the enlargement and fissiparous division of the nuclei of the cells, and the subsequent expansion of these into cells, the nuclei of which undergo similar changes. This was pointed out as being strongly confirmatory of the theory of Schwann with reference to the tissues generally, and as being in full accordance with the observations of Kölliker on the yolk cells, and with original observations which Mr. Newport has himself made on other structures.

The formation of the external respiratory organs was then examined. These were shown to commence in the tegument in spaces

between the cells, which open into follicles connected with sinuses in the granular tissue of the body, and that the orifices (the spiracles) at first very closely resemble the stomata of plants. The parietes of these follicles in *Meloë* are formed by aggregations of exceedingly minute, nucleated embryo-cells of rounded shape, and about one five- or one six-thousandth of an inch in diameter.

The tegument of the head, and more especially that of the eye of the young *Meloë* was then examined, and the cornea, which in this stage of the insect's existence is a single structure, fitted only for near vision, was shown to be composed of numerous transparent dermal cells, continuous with those which form the surface of the head, while the centre of the cornea, the axis of vision, is occupied by a single cell, more projecting and twice the size of those which surround it.

The changes which take place in the relative development of different parts of the tegument of the young *Meloë*, which lead to its entire alteration of form, were then pointed out, and shown to occur chiefly in the rapid growth of the dorsal region, which from being originally the smallest, as it is the last-formed part of the body, becomes the most voluminous, and occasions a complete alteration in the position and size of the limbs and in the entire form of the insect.

The stages of this process and the formation of the dermo-skeleton, the author proposed to be considered in the next section of this memoir.

Nov. 16.—The Lord Bishop of Norwich, President, in the Chair.

E. Doubleday, Esq., F.L.S., read a paper "On the Pterology of the *Diurnal Lepidoptera*, especially upon that of some genera of the *Heliconidæ*."

After expressing his regret at the little attention bestowed in this country upon the anatomy of the *Annulosa*, the writer proceeded to remark that he was not aware that any author had recorded the fact of a sexual variation in the neuration of the wings of *Lepidoptera*, a fact extremely interesting from the light it throws on the homologies of the nervures and nervules.

The variation takes place in the genera *Ithomia*, *Mechanitis* and *Sais*, all remarkable also for the great sexual variation in the structure of the anterior legs, those of the males being the least developed, those of the females the most developed, of any butterflies with suspended pupæ.

The state of atrophy of the anterior feet of the males is not, he states, the consequence of excessive development of the other pairs of feet, or of any other organs, nor does it appear to depend on any peculiar habits of the insect; neither can the greater development of these feet in the females be accounted for by any difference of habits. For the more developed anterior feet of some male *Coleoptera*, for the powerful jaws of the leaf-cutting or timber-boring bees, there are obvious uses; but a greater development in the one sex of organs almost atrophied in the other, which still leaves them unfitted

for the functions they perform in a normal state, and apparently does not render them useful for any other function, can only be explained by conceiving it in some way to depend on the position of the animal in the system of Nature.

The system of neuration of the posterior wings in the *Diurnal Lepidoptera*, which may be considered normal as regards this group, is abnormal as it respects the whole order; and it would seem as though Nature, by a partial return to a normal structure in a few genera, wished to indicate to us the real homologies of these parts.

In general the posterior wings of the *Diurnal Lepidoptera* have the discoidal nervure, which in these wings never branches, so placed as to seem to be a third subcostal nervule; but in some genera, although its basal is always wanting, its real character is very evident, and it is united to the subcostal nervure or one of its nervules, and also to the median nervure or one of its nervules, by distinct upper and lower disco-cellular nervules. In the *Heliconidæ* we find this structure, almost normal as it respects the order, in the genus *Ituna*, and also in *Ithomia*. It is found in some female *Ithomiæ*, of which the males have a different structure, giving indications of that change of position which in the next genus might lead us to mistake the discoidal nervure for a fourth median nervule, the disco-cellular nervules being placed more obliquely, the cell becoming thereby more elongated, and the lower disco-cellular nervule appearing almost to form a continuation of the median nervure. In *Mechanitis* both sexes have this character further carried out, and the wing appears to have a subcostal nervure dividing into two nervules, and a median dividing into four, so completely has the discoidal nervure assumed the position of a branch of the latter nervure. The females of the genus *Sais* have also this character, but in the males we find a still further change of structure. In these the second subcostal nervule assumes the position of a fifth median nervule, and the subcostal nervure consequently appears simple.

Thus, leaving the genera *Heliconia*, *Lycorea* and their immediate allies, which have the structure which is normal as regards the *Diurnal Lepidoptera*, though abnormal as regards the order, we find in *Ituna* and some female *Ithomiæ* a structure nearly normal as regards the whole order, but the males of the latter become abnormal in an opposite manner to the prevalent character of the group; next in *Mechanitis* we find this structure common to both sexes; and then in *Sais*, the females retaining the same structure as in *Mechanitis*, but the males varying still further from the type.

This gradual change in the position of the discoidal nervure actually occurring first in the two sexes of the same species, and then becoming common to both sexes, is, in the opinion of the writer, confirmatory in the highest degree of the theory laid down by him in a former paper, as to the structure of the anterior wings of the *Diurnal Lepidoptera*, and leaves, he thinks, no room to doubt the correctness of the explanation there given of the apparent anomaly of those wings in the *Papilionidæ*.

In the sexual variations detailed above, it is the male insect which varies most from the type, but the females of some species of *Mechanitis* present a remarkable structure in the anterior portion of the wing, the costal nervure being united to the subcostal for the greater part of its course.

An additional interest attaches to these peculiarities of the wings, from their being combined with the great peculiarities above referred to in the structure of the anterior feet.

The writer then proceeded to point out some analogies in the structure of the wings of the *Ithomiæ* and some *Hymenoptera*, especially as regards the inner margin of the anterior wings and the anterior margin of the posterior wings, and also with reference to a fringe of hairs on the latter, analogous to the hooks occupying the same position in the Bees and other *Hymenoptera*.

December 7.—E. Forster, Esq., V.P., in the Chair.

Read a "Description of a new genus of *Lentibulariæ*, with remarks on some Indian species of *Utricularia*." By M. Pakenham Edgeworth, Esq., F.L.S. &c.

Gen. Nov. Diurospermum.

Calyx bilabiatus, labio superiore 2- (rarius 3-) dentato. *Corolla* bilabiata, tubo brevi, labio superiore brevissimo truncato, inferiore 3-dentato. *Stamina* inclusa. *Stylus* brevis, stigmate dilatato. *Capsula* ovata, oligosperma; placentâ centrali liberâ conicâ in apicem productâ. *Semina* pauca (prope 6), ovata, testâ laxâ striato-rugosâ, utrinque pilis paucis longis caudata. *Nucula* compressa, submarginata. *Embryo*? —Herba *pusilla, acaulis,* foliis *radicalibus,* radicibus *utriculiferis.*

Diurospermum album.

Hab. super rupes madidos, in Vishnugangetis valle, Himala; alt. 8000 ped.

This little plant, the author thinks, forms a link connecting *Lentibulariæ* with *Cyrtandraceæ,* to which order its tailed seeds show an approximation. Unfortunately he has not been able to separate the embryo so as to be satisfied with its nature and direction. In habit it resembles slightly some of the section *Oligocista* of *Utricularia.*

Utricularia (subgenus *Oligocista*) foveolata, radicibus fibrosis brevibus, scapo simplici aphyllo 2—6 floro racemoso sinistrorsùm volubili, bracteis solitariis ovatis acutis basi-fixis pedicello vel longioribus vel multo brevioribus, lobis calycinis pedicello longioribus ovatis acutis corollam subæquantibus in fructu cum pedicello defracto valdè auctis, corollæ labio inferiore vix concavo margine 3-lobo superiore bifido: calcare conico labii inferioris longitudine, capsulâ cernuâ calyce aucto obtectâ, seminibus majusculis compresso-trapezoideis rugoso-foveolatis foveolis nitidis punctatis.

Hab. in Bengaliâ, uliginosis, Januario.

An *U. uliginosa,* DC., no. 66. vol. viii. p. 15? Flos purpureus, scapus rubescens.

Utricularia polygaloides, radicibus fibrosis, scapo aphyllo erecto plus minus ramoso 2- v. multi-floro, squamis adpressis ovatis acutis, bracteis ternis exterioribus ovatis acutis interioribus subulatis pedicello compresso æqualibus vel longioribus, lobis calycinis ovatis acuminatis sub-

æqualibus, corollæ azureæ calycem æquantis labio inferiore majore margine externe revoluto: palato convexo intus barbato: calcare conico albido labium æquante in lobo calycis inferiore nidulante; labio superiore rotundato 4-crenato, capsulâ cordatâ compressâ lobis calycinis valdè acutis arctè obtectâ, seminibus rugoso-striatis.

Hab. in Bengaliâ, prope Bardwān, uliginosis, Januario.

An *U. reticulatâ*, DC., no. 90. p. 19? differt tantum (secus descriptionem) pedicellis bracteis brevioribus, labii superioris margine non revolutâ. Planta 2—10 pollicaris, stricta. Semina oblonga, testâ laxiusculâ rugoso-striatâ, inter nervulos prominulos minutius striatâ. Labium inferius 2 lin. long. Calycis lobi per anthesin 2, in fructu 4 lin. longi. Staminum filamenta arcuata; antheris approximatis medio constrictis. Stigma sessile infundibuliforme. Folia nulla?

Utricularia rosea, radicibus fibrosis, scapo filiformi subesquamato demùm subvolubili apice racemosim 3—10 floro, bracteis ternis exteriore medio fixâ utrinque acutâ lateralibus ovatis acutis pedicello nitido subæqualibus, lobis calycinis rotundatis suborbiculatis corollâ brevioribus, corollæ roseæ labio inferiore 3-lobo (lobo medio breviore) crenulato intus fornicato palato luteo intus papilloso: calcare obtuso labium æquante; labio superiore rotundato, filamentis arcuatis apice valdè dilatatis; antheris ovatis medio paulò constrictis, capsulâ subglobosâ calycem vix auctum subæquante uno latere valvulâ sursum basi recurvatâ dehiscente, placentâ centrali globosâ foveolatâ, seminibus (plurimis abortivis) ovatis punctis prominulis subechinatis rugoso-striatis.

Hab. in Bengaliâ, prope Bardwān, uliginosis.

An *U. nivea*, DC., no. 98, at floribus roseo-purpurascentibus, capsulâ calycem æquante nec minore, nec longiore ut in *U. racemosâ*, squamis quoque minimis, an potius omnes in unam speciem reducendæ? Scapi calycesque rubescentes.

Utricularia pterosperma, radicibus fibrosis parcè utriculiferis, utriculis 1-setosis, scapo aphyllo purpurascente 2- (an pluri-?) floro ad axillam squamâ ovatâ obtusâ basifixâ bracteato, pedicellis teretibus superiore bracteolato, lobis calycinis obovatis cucullatis obtusis corollâ dimidio brevioribus nec in fructu auctis, corollæ luteæ labio superiore suberecto concavo integro; inferiore integro marginibus revolutis: palato magno aurantio-striato utrinque glabro faucem obtegente: calcare sursùm curvato conico acutiusculo labio sublongiore, staminum filamentis crassis arcuatis supra antheram 1-locularem nec constrictam productis, polline orbiculari rugosulo, stigmate bilamellato, capsulâ latere compressiusculâ subglobosâ stylo apiculatâ, placentâ globosâ alveolatâ, seminibus paucis latè alatis alâ irregulariter dentatâ reticulatim venosâ; testâ irregulariter rugosâ; nuculâ globosâ; radiculâ et plumulâ distinctâ ceterum pingui.

Hab. in Bengaliâ, Bardwān, uliginosis, Januario.

Ab *U. diantha* quâcum maxime affinis differt pedicellis teretibus nec marginatis, calcare ascendente labio longiore nec descendente, lobis calycinis in fructu *non auctis* antherisque non constrictis. An semina *U. dianthæ* alata?

Utricularia fasciculata, vide DC., no. 8. p. 18. no. 18, adde:—Placentâ globosâ spongiosâ, seminibus compressis marginatis rugosulis uno latere foveolato altero prominulo.

A further communication, from a letter written by Mr. Edgeworth, dated Banda, 30th August, 1847, was made to the meeting, respecting a remarkable effect produced by the leaves of *Gymnema*

sylvestris, R. Br., upon the sense of taste, in reference to diminishing the perception of saccharine flavours.

Read also a paper "On the Formation and Use of the Air-Sacs and Dilated Tracheæ in Insects." By G. Newport, Esq., F.R.S., F.L.S. &c. &c.

The paper was commenced with the remark, that the presence of air-sacs in insects is known to every comparative anatomist. These sacs are largest and most numerous in the *Hymenoptera*, *Lepidoptera* and *Diptera*. They are numerous and capacious in the *Dragon-flies* among the *Neuroptera*, but are smaller and fewer in the *Ephemeræ*, the *Sialidæ* and the *Scorpion-flies*. In the *Coleoptera* they exist only in the volant species; and even in the same tribe, as in the *Carabidæ*, they are found in the winged, but not in the apterous species. In all insects in which they occur they are largest and most numerous in the swiftest and most powerful individuals. They are found in the *Orthoptera* only in the migratory families; while in those which are truly saltatorial insects the tracheæ are enlarged in some parts of their course, but are not to be regarded as properly sacculated, and sacs are never found in the larva state of any species of insect. The sacs are formed by the dilatation of tracheæ during the metamorphoses of the insects, which commences at the close of the larva state, when the insect has ceased to feed. This dilatation goes on for the first few days only in those species which hybernate, and is resumed again in the spring, but it continues uninterruptedly to the development of the perfect insect in those which change to that state in the summer.

The author showed that the longitudinal tracheæ of the third and fourth segments of the larva of winged insects give off a small branch at the sides of each segment, which, divided into two portions, passes outwards and "is involved in a fold of the new tegument that is formed beneath the old skin of the larva some days before its change. These folds of tegument supplied each with their tracheæ closely resemble in appearance the external abdominal branchiæ of the aquatic larvæ of *Neuroptera*," and afterwards become the most important organs of the insect in its perfect state—the wings. The expansion of these organs at the change is mainly effected by their tracheæ, which instead of becoming dilated, like those within the body, are elongated, and thus induce a rush of blood into these portions of the tegument which promotes their expansion into wings. This elongation, as well as the dilatation of the tracheæ within the body, is the result of powerful respiratory efforts of the insect. The author remarked, that although able to show the mode in which these changes are effected, it is less easy to give a satisfactory explanation of the real use of the vesicles. He adopts, however, a view entertained by John Hunter, that the vesicles are mainly to enable the insect to alter the specific gravity of its body at pleasure during flight, and thus diminish the muscular exertion required during these movements. To support this opinion, the author reviewed the different classes of Vertebrata, and showed that although a vesicular form of the respiratory organs exists in the whole, yet that Birds approach

much more closely to Insects in this respect, as well as in the more extensive distribution of the organs themselves, than any other of the Vertebrata; and he referred to the fact that in apterous insects, as in birds that are unaccustomed to flight, the respiratory organs are less capacious or less extensively distributed. This fact, he stated, is not confined to insects of which both sexes are apterous, but that when one sex is winged and active in flight, and the other apterous, he has always found the body of the former with vesicular tracheæ, while in the other, the apterous sex, the tracheæ are simply arborescent, as he has found in the sexes of the glow-worm, and in the common winter-moth, *Geometra trumaria*. These facts, inferential with regard to the use of the vesicles, the author supported with an account of an experimental observation on the mode in which the common dung-beetle prepares itself for flight, by rapidly increasing its respiration and distending its body the instant before it unfolds its wings and attempts to raise itself upon them.

January 18, 1848.—N. Wallich, Esq., M.D., in the Chair.

Read a paper "On the genus *Atamisquea*." By John Miers, Esq., F.R.S., F.L.S. &c.

Of this Capparideous genus, named by Mr. Miers in his 'Travels in Chile,' vol. ii. p. 529, and subsequently characterized by Sir W. J. Hooker in his 'Botanical Miscellany,' Mr. Miers gives the following more complete character, derived from the living plant.

Atamisquea, *Miers.*

Char. Gen. *Sepala* 2, ovoidea, concava, æstivatione marginibus subimbricatis, in torum carnosum, cyathiformem persistentem demùm induratum dentibus erectis notatum coalita, decidua. *Petala* 6, e margine tori orta, inæqualia, lineari-spathulata, reflexa; 2 superiora erectiora, æstivatione subimbricata; 2 lateralia breviora, exteriora. *Stamina* 9, quorum 6 fertilia longiora; *filamenta* æstivatione replicata, demùm recta, reclinata, glabra, basi glandulosa, lepidota; *antheræ* oblongæ, 2-loculares, basifixæ, erectæ, demùm curvatæ. *Thecaphorum* declinatum; basi glabrum, disco staminifero cinctum, hinc geniculatum; indè gracile, elongatum, et cum ovario lepidotum. *Ovarium* ovatum; *stylus* brevissimus; *stigma* obtusè 2-lobum. *Bacca* ovoidea, subcarnosa, densè lepidota. *Semina* 2 (vel abortu 1), exalbuminosa, cochleato-reniformia, funiculo libero erecto bifurcato ex imo loculo orto lateraliter appensa; *testa* coriacea, loculo altero incompleto hilo opposito. *Embryo* campylotropus; *cotyledones* magnæ, foliaceæ, incumbentes, invicem plicato-convolutæ; *radicula* teres, infera, loculo incompleto velata, et ob embryonis curvaturam hilum supernè spectans.—Frutex *durus, ramosus,* Americæ meridionalis extratropicæ; ramis *abbreviatis, junioribus lepidotis, nonnunquam spinescentibus*; foliis *e ramulis junioribus orta, parva, alterna, brevissimè petiolata, canaliculata, æstivatione conduplicata, subtùs lepidota, costâ carinatâ.* Pedunculus *axillaris, solitarius, 1-florus.*

Atamisquea emarginata, foliis lineari-oblongis basi apiceque emarginatis suprà viridi-nitentibus subtùs hirsutis incanis squamisque lepidotis tectis.

Hab. in campis patentibus, aridis, salinis, Travesia dictis, Provinciæ Mendozæ Chilensis.

Mr. Miers states that he offers the above view of the floral envelopes (which he regards as consisting of 2 sepals and 6 petals) with much deference, especially as that which Sir W. J. Hooker has taken of them is in conformity with the usual arrangement of the family. It appears to him, however, to be warranted by the fact that the two broad external leaflets (which he considers as the calyx) form one entire whorl, being continuous at their origin with the margin of the cup of the torus, while the insertion of the six narrower segments (petals) is also upon one line, within the margin of the same cup; the cicatrix of the calyx being marked by a clean line on the margin of the cup, while the remains of the claws of the petals are distinctly seen within the same margin forming so many projecting indurated teeth. This (as regards the calyx) is analogous with what occurs in *Busbeckia*, Endl., *Steriphoma*, Spr., and *Morisonia*, Plum., in all of which only 2 sepals exist, or an entire envelope bursting into two valves. To reconcile the apparent anomaly, the author would consider the floral envelope of *Atamisquea* either as formed of three series, each consisting of two normal parts, the innermost series appearing double in consequence of the division of its lobes to their point of insertion; (and this view is supported by the cohesion of the upper and lower pairs of petals at their base when pulled away from the torus, while a distinct interval is manifest between each of these pairs and the shorter lateral petals;) or he would (still taking the same view with regard to the composition of the upper and lower pairs of petals) regard them as forming with the two lateral petals a whorl of four parts, and suppose the outer series also (the sepals) to be normally four in number, united by adhesion into two. This last view he considers to be rendered somewhat the more probable by its approximating more nearly to the usual structure, and by the fact that each of the sepals when dried readily splits down the middle by a clean line into two distinct segments.

The paper was illustrated by detailed illustrations of the structure of the plant.

February 1.—Robert Brown, Esq., V.P., in the Chair.

J. O. Westwood, Esq., F.L.S. &c., exhibited specimens of the silk spun by the caterpillars of the new Indian silk moth, *Bombyx Huttoni*, Westw. (figured in the 'Cabinet of Oriental Entomology,' pl. 12. fig. 4), communicated to him by Capt. T. Hutton. After stating the importance of the discovery of a new and valuable product of this nature in our foreign territories, and that the 'Transactions of the Linnean Society' contained a valuable paper on East Indian silk insects by Gen. Hardwicke, Mr. Westwood observed that the insect discovered by Capt. Hutton was congeneric with the real silk insect, *Bombyx Mori*, a native of China, whereas those described in the Transactions of the Society belonged to another genus, *Saturnia*, and that consequently the silk spun by the new species was likely to approximate nearer to that of *B. Mori* in its qualities than that of the large Indian *Saturniæ*. The new species had been discovered to be a native of the hills about Mussooree, on the south-

ern side of the Himalaya, 6500 feet above the level of the sea, and its caterpillar (like that of *B. Mori*) feeds on the leaves of the wild mulberry, which is another reason why the qualities of the silk should resemble that spun by the true silkworm. The perfect moth is about the size of *B. Mori*, but has darker-coloured wings, with a large, blackish lunate spot near the tips of the hooked fore-wings.

Specimens of the natural fibre of the silk, and some with the threads severally composed of three, six, nine and twelve fibres were exhibited, those with nine and twelve fibres having been pronounced by the Delhi silk-workers to be worth 25 rupees per seer, that is, about 25 shillings per pound, at 2 shillings per rupee.

Read a paper entitled "Descriptions of some new species of *Athyreus*, MacL., a genus of Lamellicorn Beetles." By J. O. Westwood, Esq., F.L.S. &c.

After tracing the history of the genus and its affinities, and noticing in detail its most remarkable peculiarities, dwelling particularly on those characters which are externally indicative of distinction of sex, Mr. Westwood proceeds to describe the following species:

1. Athyreus gigas, *Hope*; castaneus, elytris magis rufis, capite glabro anticè 3-cornuto, mandibulis magnis externè acutè dentatis, pronoto utrinque excavatione profundâ discoque cornubus duobus crassis acutis divergentibus, elytris tenuissimè striato-punctatis.—Long. corp. unc. 1 (mandibulis inclusis).

Hab. in Brasiliâ. In Mus. D. Hope.

2. Athyreus armatus, *Hope*; piceo-niger, lateribus prothoracis mandibulis pedibusque rufescentibus, mandibulis magnis singulâ extùs 2-dentatâ dente antico magno, pronoto utrinque carinâ deflexâ medioque cornu suberecto, elytris elevato-striatis.—Long. corp. lin. 9.

Hab. in Americâ meridionali. In Mus. D. Hope.

3. Athyreus subarmatus, ♀; suprà obscurus nigricans, labro mandibulis prothoracis lateribus pedibusque piceo-rufis, tenuissimè granulosus, clypeo margine antico parùm reflexo posticè carinâ elevatâ in medio tuberculo instructo, antennis luteis, pronoto carinis duabus brevibus mediis in spatio medio ovali lineâ elevatâ circumcincto instructo. —Long. corp. lin. 8½.

Hab. in Americâ meridionali. In Mus. D. Hope, sub nomine *A. armatus*, ♀.

4. Athyreus tuberculatus, *Hope*; obscurè piceus, sub lente tenuissimè granulosus et setosus, antennis luteis, clypeo conico anticè cornu parùm elevato terminato, pronoto tuberculis duobus contiguis ante medium disci positis, elytris sublineatis, tibiis anticis 5–6-dentatis.—Long. corp. lin. 8½.

Hab. in Brasiliâ. In Mus. D. Hope.

5. Athyreus rotundus, *Hope*; suprà obscurus piceo-rufus, sub lente undique tuberculis minimis obsitus, clypeo margine antico truncato et parùm elevato margine postico carinâ tuberculis tribus acutis instructo, pronoto tuberculis duobus contiguis ante medium elytrisque læviter striatis.—Long. corp. lin. 10.

Hab. in Brasiliâ. In Mus. D. Hope.

This insect Mr. Westwood thinks to be probably the female of *A. tuberculatus.*

6. Athyreus bellator; piceo-niger, capite et pronoto (marginibus exceptis) sublævibus hujus marginibus lateralibus pedibusque rufis vel fulvis, clypeo in dentem acutum elongato, pronoto dente elevato bifido pone medium armato.—Long. corp. lin. $10\frac{1}{2}$.
Athyreus bifurcatus, *Laporte, An. Art.* iii. p. 102. pl. 7. f. 3. (*nec* A. bifurcatus, *Klug, nec* A. bifurcatus, *MacL.*)
Athyreus furcifer, *Dej. Cat. et Laporte, An. Art.* l. c. (*teste Mus. Gory.*)
Hab. in Brasiliâ et Cayennâ. In Mus. D. Hope.

The present species stands in Mr. Hope's collection as the male of *A. Bilbergii.*

7. Athyreus Bilbergii, *Gray in Griffith An. Kingd.*; piceo-niger, tuberculis minutis scaber, clypei margine antico recto postico carinato et 3-tuberculato tuberculo intermedio magis elevato, angulis lateralibus capitis ante oculos acutis, pronoto margine antico parùm elevato; disco tuberculis duobus lævibus lineisque duabus curvatis elevatis.—Long. corp. lin. 10.
Athyreus furcicollis, *Dej.* (*teste Mus. Gory, nunc Hope.*)
Hab. in Demerarâ et Cayennâ. In Mus. D. Hope.

8. Athyreus Pholas, *Buquet MS.*; piceo-castaneus, lateribus prothoracis et elytrorum pedibusque rufescentibus, scabriusculus, clypeo anticè angustato margine antico bituberculato, vertice concavo, prothoracis lateribus dilatatis disco excavatione subquadratâ spinâ erectâ anticâ lateribusque acutè tuberculatis.—Long. corp. lin. 6.
Athyreus trituberculatus, *Gory in Mus.*
Hab. in Colombiâ, Santa Fè de Bogota. In Mus. Hope.
Obs. *Athyreus recticornis*, Guérin, Iconogr. du Règne An. Ins. p. 83, from Swan River (Mus. Gory)=*Bolboceras hastifer*, Bainbridge.

The insect placed in M. Gory's collection, with the label of *Athyreus porcatus*, De Laporte, Anim. Artic. t. ii. p. 103. no. 6, *Athyreus Senegalensis*, Dejean, is a new species of *Bolboceras*, from Senegal.

9. Athyreus purpureipennis; cyaneo-niger subtùs fulvo-testaceus, elytris lætè purpureis, pronoto lineâ longitudinali impressâ utrinque spatio convexo lævissimo nigro versus angulos anticos furcato.—Long. corp. lin. 6.
Hab. in Americâ meridionali. In Musæo Britannico.

10. Athyreus centralis; testaceo-fulvus, capitis vertice anticè 3-dentato, pronoto carinâ abbreviatâ centrali lineis duabus parum elevatis obliquis alterâque utrinque prope angulos posticos, elytris impresso-striatis striis longe ante apicem evanescentibus.—Long. corp. lin. $6\frac{1}{2}$.
Hab. in Novâ Grenadâ, Rio Magdalena, Ibaque. In Musæo Britannico.

11. Athyreus Tweedyanus; testaceus, pronoto maximo lateribus obtusè angulatis et sinuatis medio disci depresso lævi et lineâ obliquâ parùm curvatâ e lateribus separato lineâque alterâ abbreviatâ utrinque versus angulos posticos.—Long. corp. lin. $5\frac{3}{4}$.
Hab. in Insulâ Hayti, Indiæ occidentalis. DD. Tweedy et Hearne. In Muss. Soc. Ent. Londin. et Hope.

ROYAL SOCIETY.

March 23, 1848.—"Observations on some Belemnites and other fossil remains of Cephalopoda, discovered by Mr. Reginald Neville Mantell, C.E., in the Oxford Clay, near Trowbridge in Wiltshire." By Gideon Algernon Mantell, Esq., LL.D., F.R.S., Vice-President of the Geological Society.

The author states, that a line of railway now in progress of construction to connect the large manufacturing town of Trowbridge with the Great Western, being part of the Wilts, Somerset, and Weymouth line, traverses extensive beds of the Oxford clay of the same geological character as those at Christian-Malford in the same county, which furnished the remarkable fossil cephalopods described by Mr. Channing Pearce under the name of *Belemnoteuthis*, and by Professor Owen (in a memoir which received the award of a Royal Medal of this Society), as the animals to which the fossils commonly known by the name of *Belemnites* belong.

The son of the author, Mr. R. N. Mantell, being engaged in these works under the eminent engineer Mr. Brunel, availed himself of the opportunity to form an extensive and highly interesting collection of the fossils of the Oxford clay, and other oolitic deposits cut through or exposed by the engineering operations. Among those transmitted to the author are many illustrative examples of Belemnoteuthes and Belemnites; some of which confirm the opinions entertained by the late Mr. C. Pearce, Mr. Cunnington, and other competent observers, that the body and soft parts, with the cephalic uncinated arms, &c. of cephalopods, obtained from Christian-Malford by the Noble President and Mr. Pearce Pratt, and referred by Professor Owen in the memoir above-mentioned to the Belemnite, belong to a distinct genus—the Belemnoteuthis.

The author describes and figures several perfect examples of the phragmocone of the Belemnoteuthis, and institutes a comparison between them and a beautiful example of the phragmocone of a belemnite occupying the alveolus of the guard; and defines the essential differences observable in the form and structure of these chambered calcareous cones. He especially points out as distinctive characters of the phragmocone of the Belemnoteuthis, two flat longitudinal ridges which extend upwards from the apical extremity, and the granulated and striated external surface of the epidermis. The phragmocone of the Belemnite has a smooth surface, is destitute of any longitudinal ridges, and terminates at the apex in a very fine point, the axis being in an oblique direction.

The author next describes a remarkable specimen of a Belemnite, twenty-two inches in length, in which the osselet or guard, phragmocone, and capsule or receptacle, are preserved in connexion. In this fossil is demonstrated, for the first time, the upper or basal termination of the phragmocone, with two elongated calcareous processes extending upwards from the margin: these are analogous in form and position to the prolongations from the peristome of the

outer chamber of certain Ammonites, as for example, in *A. Jasoni.* In the phragmocone of the Belemnoteuthis the peristome is entire.

Another interesting part of the structure of the Belemnite, not previously detected, is also shown in the same specimen, as well as in many other examples found in the Oxford clay near Trowbridge; namely, a calcareous shelly periosteum or capsule, which invests the guard, and expands upwards into a horny sheath or receptacle, that surrounds the basal chamber of the phragmocone in which the viscera were probably contained. This receptacle was formerly supposed to originate from within the alveolus of the guard. Mr. Miller, many years ago, inferred the existence of a vascular integument around the guard from the meandring impressions of blood-vessels observable on the surface of some specimens; but the presence of a calcareo-corneous capsule or sheath investing the guard, and expanding into a horny receptacle, has not till now been demonstrated.

The author considers the facts described as proving that the cephalopod of the Belemnite was entirely distinct from the Belemnoteuthis; and that the muscular mantle, cephalic arms, and other parts referred by Professor Owen to the former, exclusively belong to the latter genus.

He concludes that the remains of at least three genera of naked Cephalopoda occur in the argillaceous deposits of the oolite in Wiltshire; namely, the first or true *Calamary*, with a horny dorsal gladius or pen; the second, the *Belemnoteuthis*, or a decapod with uncinated cephalic arms, ink-bag, pallial fins, and a corneo-calcareous phragmocone; and the third, the *Belemnite*, which possessed a phragmocone having the apical part implanted in the cavity or alveolus of a guard or osselet, which in its original state resembled in substance the sepiostaire of the Cuttle-fish, but is generally found mineralized by calcareous spar; and the peristome, possessing two or more elongated shelly processes; both the guard and the phragmocone being invested with a corneo-calcareous capsule or receptacle. He observes, lastly, that the body and other soft parts of the cephalopod of the Belemnite are at present unknown. The author's communication was illustrated by drawings, and accompanied by the specimens above described.

MISCELLANEOUS.

On a new genus and species of Fossil Ruminantia, Poëbrotherium Wilsoni. By Joseph Leidy, M.D.

Indirectly through Mr. J. S. Phillips and the influence of Dr. S. G. Morton, the Academy has become the depositary of a valuable and unique fossil, received through Dr. S. D. Culbertson of Chambersburg, Pa., from Mr. Joseph Culbertson.

As first received, it consisted of a mass of argillaceous limestone, having one side of a cranium of an animal exposed to view, which, by the patience of Dr. T. A. Wilson, was relieved of its matrix; and

the lower extremity of the humerus, and the upper extremity of the ulna and radius of the right leg were also disclosed.

The top or vault above the orbits, and posterior part of the cranium, are wanting, as are also the ossa nasi, ossa intermaxillaria, the part of the os maxillare inferius just anterior to the commencement of the symphysis, and the zygoma of the left side, but sufficient is left to characterize it as a remarkable genus of Ruminantia, very different from any that has been heretofore described.

The cranium belonged to a full-grown or adult animal, but not an old one, as is indicated by the teeth.

In the upper jaw are seven molars, differing in this respect from any ruminant known, living or fossil. The posterior three molars, usually called true, present nothing very peculiar in their conformation. They are not so square as in *Cervus*, but are more like those of *Ovis*, being much broader than wide, so that they have a compressed appearance. The four crescents upon the crowns are quite simple. Externally these teeth present two and nearly plane surfaces, separated by an abrupt, salient, longitudinal ridge on a line with the notch separating the anterior and posterior pair of columns. Each of these surfaces has a longitudinal rounded ridge, more prominent upon the anterior than the posterior one, but neither so salient as the first. The antero-external border is also elevated or prominent, so that each of these teeth presents externally four longitudinal ridges. As is usual, these teeth are obliquely situated in the jaw, and the anterior part of one folds over externally, or overlaps the posterior part of the one preceding it.

The anterior four molars or premolars are not more than half the length of the true molars, and differ among themselves so as to render it necessary to examine them separately. The posterior or fourth premolar has more the characteristics of a true molar, and it would probably not be wrong to consider it as an additional true molar. The crown presents four crescents, which are thicker than in the true molars, and the anterior and posterior pair are separated by a comparatively deeper notch. Externally the tooth has four ridges corresponding to those of the true molars. The third premolar, or the one immediately preceding the last, has upon its crown a posterior pair of thick crescents, and an anterior cusp which has the appearance of being formed by the blending together of a pair of crescents. Externally it is trilobed, the lobes being separated by two concave depressions. It is shorter, but broader, than the last. The second premolar is compressed, faintly trilobed, and presents an elongated trenchant crown. The first premolar is the most remarkable characteristic of this cranium. It is separated from the others by a concave notch of ·333 of an inch, and is on a line with the anterior mental foramen. It is implanted in the jaw by two fangs, which are divergent and placed one anterior to the other. The body is nearly as broad as the second premolar and is of a compressed pyramidal form, and the crown has a trenchant edge, the posterior and anterior part of which form an angle about its centre.

In the lower jaw, in the specimen, are six inferior molars in a

closed row commencing ·25 of an inch anterior to the corresponding six molars above, and continuing as far back as the latter. Besides these, and separated from them by a concave, descending notch of ·45 of an inch, just anterior to the anterior mental foramen, or ·15 of an inch anterior to the commencement of the symphysis posteriorly, is one-half of an alveolus for an additional or seventh molar, which, when the specimen was first received, contained a portion of a fang, since mislaid. This additional molar in the lower jaw is possessed by only one other known genus of Ruminantia, the *Dorcatherium* of Kaup.

The crowns of the inferior molars are enveloped in the matrix in such a manner that they cannot be exposed without endangering the specimen. Externally the three true molars present their columns as sharply triangular prisms, as in *Ovis*, &c., and have no intervening points or cones, as in *Cervus*, *Dorcatherium*, &c.

The fourth premolar is trilobed externally, each lobe presenting a cusp towards the crown. The third and second are compressed, and the latter, I can perceive, has a trenchant crown.

The position of the molars, though resembling that of *Dorcatherium* considerably more than that of any other genus of Ruminantia, differs materially from it; for while the teeth reach to the symphysis in the latter, in the former they even extend anteriorly to its commencement.

From the foregoing description of the teeth, it will be perceived, that in the possession of a seventh molar in the upper jaw, in the position of the molars, and in several other minor peculiarities, this genus differs from all others heretofore known, and is well characterized, and I therefore propose for it the name of "*Poëbrotherium* *."

[We omit some further details, and pass to the concluding remarks.]

These bones belonged to an animal rather less in size than the *Dorcatherium*.

The species I have designated *Wilsoni*, in honour of Dr. Thomas B. Wilson, a munificent patron of the natural sciences.

Probable habit of the animal.—From the evidences of considerable muscular strength in the posterior part of the inferior maxilla and the trenchant crowns of the anterior premolars, it might be supposed that the animal was adapted to eating flesh as part of its food, as was thought by Cuvier to have been probably the case with the *Anoplotherium gracile*, a pachydermous animal having very similar characters; but I should think its general structure would entirely preclude the idea of its having been able to catch living animal prey, and doubt very much whether its food could have been other than vegetable. The anterior trenchant molars were more probably intended for cutting branches and twigs of bushes, or tough grasses, which afterwards underwent a finer trituration with the true molars.

The position which the genus should occupy.—*Poëbrotherium* in its dentition approaches the Ruminantia to the Pachydermata, for in the number of the molar teeth and the trenchant nature of the anterior

* *πόα, herba, βρόω, pasco, θὴρ, fera.*

premolars, it is closely allied to the Xiphodont *Anoplotherium*, while in the true molars it is characteristically ruminant, and its position would therefore probably stand thus: *Dorcatherium, Poëbrotherium, Anoplotherium*.

*Measurements * of the head.*

	In.
Meatus auditorius externus to infra orbitar foramen	3·1
From point of hook-like process of inferior maxilla to anterior mental foramen	4·35
Greatest width of orbit	1·15
Narrowest part of face, below ossa nasi	·2
Width at the corono-condyloid depressions of inferior maxilla	1·6
Width at the coronoid processes	2·
Greatest width at the ossa tympani	2·1
Distance between ossa tympani	·375
Width of os tympanum	·85
Length of row formed by the posterior six superior molars	2·5
Notch between the first and second superior premolars	·333
Length of row formed by the posterior six inferior molars	2·7
Notch between the first and second inferior premolars	·45

Measurements of superior molar teeth.

	Length.	Breadth.	Thickness.
7th molar	·375	·6	·2
6th —	·4	·55	·25
5th —	·333	·45	·275
4th —	·2	·375	·25
3rd —	·15	·4	·2
2nd —	·1	·35	·1
1st —	·15	·3	·075

Measurements of inferior molar teeth.

	Length.	Breadth.
7th molar	·3	·35
6th —	·3	·5
5th —	·25	·4
4th —	·15	·45
3rd —	·1	·35
2nd —	·1	·35

Measurements from bones of fore-leg.

Transverse diameter of lower articular surface of os humeri	·75
Antero-posterior diameter in depressed portion of same	·45
Length of olecranon above the lowest part of the articular surface of the elbow	·95

From Silliman's Journal for March 1848.

On two new genera of Siliceous-shelled Polygastrica from Patagonian Guano. By Prof. Ehrenberg.

From the very large number of the typical generic forms of Polygastrica already described and arranged, new genera no longer occur so frequently; but when they do, the new forms have a greater scientific value. During his stay in England last summer Prof. Ehren-

* The measurements are taken in English inches and parts of the same.

berg noticed a very interesting form among the microscopic preparations put up with great neatness by Mr. Topping for sale. It is found in a certain kind of guano from Patagonia, and is one of the largest forms. Prof. Ehrenberg has called it *Hemiptychus ornatus*. They are isolated, comparatively very large, thin, discoid siliceous plates, which exhibit radii upon their surface connected by a very delicate network, after the manner of the genus *Actinoptychus*. These radii are likewise in the present instance raised bands, but which, commencing at the margin, do not reach to the centre, but leave a broad central disc, in which these bands are continued in the form of finely punctated radial lines to the centre where a circle of teeth are visible: no marginal apertures were perceptible.

Another new genus of Polygastrica was found in some guano from Patagonia brought by the Danish ship Waldemar.

Like all the kinds of guano hitherto examined, this Patagonian kind contains a considerable number of siliceous-shelled Polygastrica, together with numerous siliceous spicula of sea-sponges.

The most interesting form is *Entopyla australis*, a new genus. Externally it has the greatest resemblance to *Tessella*, but in its internal structure it more resembles the genus *Biblarium*. It forms quadrangular plates, which seen from the side are rounded off above and below. These quadrate tablets or boxes consist of several leaves like a book, which however are firmly connected. The leaves are parallel with the narrow sides and curved; the two external leaves are like the cover of a book, thicker and marked with thirty-two horizontal ribs. These two outer decorated leaves resemble each other in *Biblarium* but not in *Entopyla*, where one is outwardly concave and the other outwardly convex. The concave outer leaf is upon the ventral side, since it exhibits two large roundish apertures at the extremities; the opposite convex leaf has no aperture; all the intervening leaves have a large aperture in the centre, leaving only a thin margin, thus forming a large continuous space in the interior of these little boxes. The structure in *Biblarium* is similar.

This form is not quite new, a fragment of it having been brought from the Falkland Islands in the year 1843; it was then arranged as an imperfect but characteristic form with the genus *Surirella*, and called *Surirella ? australis*. It was a part of the cover of the *Entopyla*, which very much resembles the shells of *Surirellæ*.

This new guano contained—

Polygastrica.

Actinoptychus octonarius.	Grammatophora oceanica.
Cocconeïs oceanica.	serpentina.
Coscinodiscus subtilis.	Tessella Catena.
Entopyla australis.	Synedra Gallionii ?
Gallionella sulcata.	Zygoceros Rhombus ?
Grammatophora angulosa.	

Phytolitharia.

Lithodontium furcatum.	Spongolithis Clavus.
platyodon.	cenocephala.
	Fustis.

All the other forms are known sea organisms, excepting the *Lithodontia.*

Novorum Generum Characteres succincti.

Hemiptychus. Animal e Bacillariis Naviculaceis liberum. Lorica simplex æqualiter bivalvis silicea orbicularis (non concatenata ?) intus sepimentis imperfectis ad dimidiam fere radiorum partem in loculos radiantes (nec alternos impressos) divisa, medio disco late vacuo, radiato nec septato, centro, denticulorum corona cincto, radiorum experte, extremi marginis aperturis non conspicuis.

Sepimentis abbreviatis, concamerationibus non alterne impressis, centro coronato et aperturis marginalibus obsoletis ab *Actinoptycho* differt.

H. *ornatus* disco subtilissime granulato radiis 29 æqualibus, cellularum apparatu interposito concentrico. Diameter $\frac{1}{10}'''$.

Entopyla. Animal e Bacillariis Naviculaceis (an Echinelleïs ?). Lorica prismatica compressa multivalvis (libera, an concatenata ?). Valvis in serie simplici recta, libri foliorum instar, contiguis, internis apertura maxima media perviis, externis inæqualibus transverse striatis, altera integerrima (non perforata), altera ad utrumque apicem poro magno insigni.

Forma arcuata ad *Achnanthem* accedit, tabellari forma *Tessellæ* affinior est, maxime *Biblario* propinquior est.

E. *australis*, foliolis linearibus utroque fine rotundato, foliolis mediis in adultis numero fere 16, costis foliolorum lateralium in adultis ultra 40 iisque (*Surirellæ* more) linea media flexuosa divisis. Longit. $\frac{1}{20}'''$.

Vidi juniora specimina $\frac{1}{60}'''$ longa, foliolis intermediis tribus, costis inter aperturas 6.

Syn. *Surirella? australis*, 1843, Abhandl. d. Akad.—*Proceedings of the Berlin Academy.*

EXTENSIBILITY OF MEMBRANE AND MUSCLE IN THE SERPENT TRIBE.

The following facts, as illustrative of the great extensibility of membrane and muscle in the Serpent tribe, may prove interesting to some of your readers.

On the 14th ultimo a Boa constrictor was sent for my inspection, which had that morning swallowed a pig belonging to some Chinese at Sungi Kranjie. It would appear that the snake had been seen lki n g about the sty several days previous to his last meal which cost him so dear; he artfully however escaped the owner of the swine, who had ineffectually attempted his capture or destruction on these occasions; but on the morning in question, the Boa succeeded in getting entrance into the sty, and having helped himself to a porker, found himself in the dilemma of the weasel in the barn,—he could not get out again. The owner came upon him in this state of helplessness, and having called comrades to his assistance, secured the victim, torpid from his voracious exertions, and brought him in triumph into town.

Now you will say there is nothing novel in all this; nevertheless the disparity of size between the carcase of the pig and the jaws

and body of the snake struck me so forcibly, and appeared so extraordinary, that I forthwith proceeded to ascertain the exact relative proportions, and found them as follow. The snake was twelve feet nine inches long, transverse diameter of jaw inside three and a half inches, neck round nine inches, greatest girth of body at thickest part, when pig was out, eleven and a half inches. The pig weighed thirty-seven catties and a half, or rather more than fifty pounds, was a good three-fourths-grown young sow, and lay apparently without a mark of violence upon its body—not a hair ruffled, legs unbroken; indeed old Isaac Walton never dealt more tenderly with his frog than the Boa had seemingly done with young piggy. Upon closer examination it was however discovered that the ribs were broken; but as the animal remained in its place of sepulture some hours, sufficient gases had been generated to rectify the effects of the crushing and restore piggy to her pristine comeliness of shape; the contrast therefore was the more striking; but still it is quite inconceivable how the animal was ever swallowed: how the head of the pig passed the jaws of the snake, would I think puzzle a conjuror to determine; and how the snake felt I leave to the consideration of some hopeless dyspeptic. So distended were the walls of the abdomen by the unusual meal, that the whole pig could be seen plainly through them; they became diaphanous and thin as gold-beater's skin. The vitality of the monster equalled his voracity, for, despite the numberless blows of clubs on its head, two hours after the pig had been cut out of the abdomen, I saw the tail firmly coil itself around a stake. Boa met with poetical justice, for, the same evening, he descended into the very little less ravenous maws of some Chinese, who looked upon the flesh as something exceedingly piquant and appetizing, and eagerly they strove amongst themselves who should possess the largest share of it.—*From the Journal of the Indian Archipelago and Eastern Asia for Feb.* 1848.

Observations on the Nummulites. By Messrs. Jolie and Leymerie.

In this note the authors have presented the principal results of their researches upon the Nummulites, and which it is intended shall form the subject of a detailed memoir in connexion with some researches upon the *Bryozoa*, Ehrenberg, *Foraminifera*, D'Orbigny, contained in the fossiliferous deposits of the subpyrenean basin.

The fossils under consideration are arranged by all naturalists among animal productions, and are looked upon as a kind of chamber analogous to shells, but a variety of opinions prevail with respect to the form and organization of the animal of Nummulites, and the position which it occupied in relation to these paradoxical shells. Linnæus first arranged this animal among the Madrepores, subsequently he made a Medusa of it, and finally classified it among the cephalopodous Mollusca having a polythalamian outer shell. While referring the animal of the Nummulite to this order of Mollusca, Deluc, Lamarck and Cuvier considered that its shell was internal*, while Bruguière considered it to be partly contained in the last chamber

* It was impossible for G. Cuvier to adopt any other opinion, since he defined the Nummulites as shells exhibiting outwardly a lenticular form

of the shell like the Nautili and Ammonites. Persuaded that a careful investigation of the structure of the Nummulites could alone decide respecting the form of the animal which constructed these singular habitations, we set earnestly about it, and after frequently repeated observations and sections, fractions, sawings and grindings, and having examined with the microscope a multitude of Nummulites as hard as quartz or the most compact limestone, we had the good fortune to meet with a number from which we might remove successively the circumvolutions of the spire by means of a kind of cleavage, which has led us to conclude :—

1. That the *Nummulites* were external multispiral shells with enveloping convolutions, and at the same time polythalamian.

2. The sides of these shells were perforated in a similar manner to what is observed in the *Rotalia* and *Nonionina*.

3. It was through these holes that the numerous tentacula or pseudopoda with which the animal was provided were exserted (organs of prehension or locomotion).

4. The septa of the chambers leave a triangular aperture between them and the last-formed convolution of the spire by means of which they all communicate.

5. All the chambers were occupied at the same time by the multi-segmented body of the animal.

6. The several segments were connected with one another by a tube or sipho, which at the same time fulfils the office of digestive canal.

7. The animal increased by producing new segments which were added in the same plane to those previously existing. These segments were soon enveloped by the calcareous matter which they secreted, like the mantle of the Mollusca.

8. The inhabitant of the Nummulites was neither a Polyp nor a Medusa, nor an Annelide nor a Cephalopodous mollusk, but one of those long-misunderstood creatures for which D'Orbigny created the name of Foraminifera.—*Comptes Rendus, Oct.* 25, 1847.

Description of the Caligus Strömii. By W. Baird, M.D., F.L.S. &c.

In 1845 I found upon a salmon at Berwick a species of *Caligus* which, at that time, I thought was new. Upon more careful examination I found it approached very near the *Caligus Vespa* of M. Edwards, differing however considerably in size and other more minute distinctions. In the Copenhagen Transactions, vol. x. p. 23, and t. 7. f. 1–6, the celebrated Ström has described and figured a species of *Caligus* under the name of "Laxe luus" or salmon louse, and which he shortly defines "Monoculus thorace abdomineque ovato, cauda lobata." It is evidently the same as the specimens I found upon the salmon of the Tweed, and as Ström is the only author who seems to have noticed it, I have named it after him.

without any apparent aperture and internally a spiral cavity divided by septa into a number of minute chambers, but without a sipho (Règne Animal, iii. p. 22); which is the same thing as saying, that these chambers had no communication with each other nor with the exterior. From our examination of these fossils we have been led to admit the very opposite.

Caligus Strömii—Ström, Kiobenhavn, Selskabs Skrifter, x. 23. t. 7. f. 1–7.

Female. Carapace oval, the frontal plate somewhat prominent, without sucking discs; thorax about the same length as the carapace, narrower at upper extremity, broader at posterior extremity and terminating in two rounded lobes. The horny tubercles on the medium line of the lower portion of thorax above the vulva, large and simple. Abdomen long and narrow, nearly as long as the thorax, terminating in two lobes which give off several short, stout, plumose setæ. The sternal fork is short and simple. The oviferous tubes are long.—Length of whole body (exclusive of tubes) half an inch.

Male. The male is much smaller than the female. The carapace is oval, much larger in proportion to thorax than in female; thorax narrow and posteriorly notched rather than lobed on each side. Abdomen much shorter than in female, terminating setæ of caudal appendages longer and beautifully plumose. About half the size of female.

The *Cal. Vespa* (female) of M. Edwards is only 3 lines long and has the carapace narrow in front and very broad posteriorly, while in this species the carapace is almost an exact oval, and the animal (female) is fully half an inch in length. In *C. Vespa* the horny tubercle at base of thorax is small and setiferous, while in this species it is simple and of considerable size. The Vespa is said by M. Edwards to have been found in the gills of a salmon. This species I found on different parts of the body of the fish; and I have since then received specimens from Dr. Johnston, who found them also on the body of the salmon. M. Edwards does not appear to have ever seen the male.—*From the Transactions of the Berwickshire Naturalists' Club*, vol. ii. p. 259.

Fossil Infusoria in Amber.

In a paper recently read before the Berlin Academy, Prof. Ehrenberg drew attention to the occurrence of fossil Infusoria in amber, a fact of considerable interest connected with the phænomena of the tertiary formation of the earth's surface. The following nine species had already been detected by him in amber:—

Amphora gracilis.
Cocconeïs borealis.
Cocconema Cistula?
Fragilaria rhabdosoma?
Navicula affinis.
Navicula amphioxys.
 Bacillum (tenuis).
Pinnularia capitata.
 Gastrum.

Navicula amphioxys is most numerous, and with *Cocconeïs* and *Amphora* together with *Pinnularia Gastrum* form the mass.—W. F.

Obituary.

The Chevalier *Carl Johan Schönherr*, Royal Counsellor of Commerce, Knight Commander of the Royal Swedish Order of Wasa, Knight of the Polar Star, Member of the Royal Society of Stockholm, Honorary Member of the Entomological Societies of London and France, and of numerous learned bodies in Sweden and other

parts of Europe, died at his estate *Sparresäter*, in Sweden, on the 28th March ult. in his 76th year.

From a letter addressed by the Rev. Mr. Carlson, nephew of M. Schönherr and Secretary to the Swedish Legation in London, to J. Walton, Esq., we learn the following particulars respecting his decease:—He was " suddenly attacked by a fit of apoplexy on the 16th of last month (March) at eight o'clock in the evening, when he fell down on the threshold of his outer room just as he was going downstairs to join the family. The physicians did all they could to avert the danger and he got a little better, but there was scarcely any hope, and I have this day received the melancholy intelligence of his death on the 28th ult. at half-past seven o'clock in the morning. This unexpected loss of my dear and venerable relative has filled my heart with sadness, and I am sure you will feel with me, as you were a very dear friend of my late uncle."

It is impossible to speak in too high terms of the entomological productions of the deceased author. Instead of dissipating his talents by devoting them to a variety of subjects, he steadily kept in view one great object, namely the elaboration of the synonymy of the order of Coleoptera. His great work—(for in fact all his publications form but one whole)—the 'Synonymia Insectorum,'—was commenced in 1806. Three volumes successively appeared, in which the original plan was retained, namely that of giving a synonymical list of every known beetle with reference to every work in which it had been described, with the occasional addition of such species as had come to the knowledge of the author; these at first were but few in number. The 'Systema Eleutheratorum' of Fabricius had appeared a few years previously, and that author by his continual travels had made himself acquainted with the contents of the entomological cabinets of England, France and Germany. Moreover at that time the world was otherwise occupied than in collecting insects. The third volume appeared in 1817, but now time and the change of affairs had brought a great influx of novelties from distant regions, and an Appendix of new species appeared in a separate volume at the same time as the third volume.

The three volumes and appendix thus far published completed the Coleoptera as arranged in the 'Systema Eleutheratorum' of Fabricius, so far as page 376 of the second volume of that work, leaving the Rhynchophorous, Xylophagous and Brachelytrous Coleoptera untouched. The attention of Schönherr was accordingly next applied to the first of these groups answering to the Linnæan genus *Curculio*, but here the vast number of species and the modifications which had been introduced by Latreille and Dejean rendered another plan of proceeding necessary; the result of which was the publication of the 'Curculionidum dispositio methodica, seu Prodromus ad synonymiæ Insectorum partem quartam,' 8vo, Leipsic, 1826. This was succeeded in 1833 by the commencement of the herculean task of arranging the synonymy and describing the species of Rhynchophorous beetles, the extent and labour of which may be easily understood when it is stated that it has required eight thick 8vo volumes (containing more than 7000 pages) to complete the work, the last

volume containing a mantissa of new species, and it is only a very few months since we received a second mantissa of new species. Such a work of course required assistance: Gyllenhal, Germar, Boheman, and other entomological authors of the first eminence, gladly laboured in describing many of the new species, their initials being added at the end of each; and so highly was the work esteemed that we believe a grant was made by the King of Sweden to effect its completion. The 'Synonymia Insectorum' therefore forms the "*Monumentum ære perennius*" of C. J. Schönherr.—J. O. W.

METEOROLOGICAL OBSERVATIONS FOR MARCH 1848.

Chiswick.—March 1. Constant rain: barometer very low. 2. Cloudy and damp. 3. Very fine. 4. Hoar-frost: slight haze. 5. Rain. 6. Cloudy: fine: overcast. 7. Foggy: slight haze: clear. 8. Frosty and foggy: overcast: slight rain. 9. Overcast and mild. 10. Rain: fine: cloudy. 11. Boisterous, with heavy showers. 12. Showery. 13. Cloudy and cold: heavy rain at night. 14. Fine: clear and frosty. 15. Overcast. 16, 17. Rain. 18. Foggy: fine. 19. Foggy: fine: showery. 20. Heavy rain. 21. Hazy and damp: cloudy: showery: clear: frosty at night. 22. Cloudless: boisterous, with rain at night. 23, 24. Cloudy and fine. 25. Uniform haze: cloudy and fine. 26. Overcast: slight rain. 27. Foggy: drizzly. 28. Very fine: rain at night. 29. Hazy and damp: fine. 30. Foggy: slight rain: clear. 31. Hazy: very fine: clear at night.

Mean temperature of the month	42°·5
Mean temperature of March 1847	40 ·11
Mean temperature of March for the last twenty years	42 ·8
Average amount of rain in March	1·36 inch.

Boston.—March 1. Cloudy: rain last night. 2. Cloudy: rain P.M. 3. Fine: rain P.M. 4. Fine. 5. Rain. 6—9. Cloudy. 10, 11. Cloudy: rain A.M. 12. Cloudy: rain A.M. and P.M. 13. Fine: rain P.M. 14, 15. Fine. 16. Rain: rain A.M. and P.M. 17. Cloudy: rain A.M. and P.M. 18. Cloudy. 19. Cloudy: rain P.M. 20. Fine. 21. Rain: rain A.M. and P.M. 22. Fine: rain P.M. 23—25. Cloudy. 26. Cloudy: rain P.M. 27. Cloudy: rain A.M. and P.M. 28. Rain: rain A.M. 29. Cloudy: rain A.M. 30. Fine: rain P.M. 31. Rain.

Applegarth Manse, Dumfries-shire.—March 1. Fair, but cloudy and raw. 2, 3. Fair and clear: raw frost A.M. 4. Fair and clear: hard frost A.M.: rain P.M. 5—7. Cloudy, but fair. 8. Fine: wet A.M.: cleared. 9. Rain in the night: cleared P.M. 10. Showers: hail. 11. Frequent showers: hills covered with snow. 12. Clear cold day. 13. Clear cold day: frost A.M.: fine. 14. Frost A.M.: cloudy: rain P.M. 15. Frequent showers. 16. Fair, but chilly. 17. Rain during night: drizzling A.M. 18. Rain early A.M.: fine. 19. Rain and hail: snow P.M. 20. Frost: hail: thaw P.M. 21. Frost: snow on hills: hail. 22. Frost A.M.: heavy rain P.M. 23. Frequent showers. 24. Very fine: warm. 25. Very fine. 26. Rain nearly all day. 27. Very fine. 28. Wet till noon: cleared. 29. Fine: clear: cold. 30. Fine all day: light clouds. 31. Very fine: clear and warm.

Mean temperature of the month	41°·2
Mean temperature of March 1847	42 ·5
Mean temperature of March for twenty-five years	39 ·1
Mean rain in March for twenty years	2·35 inches.
Rain in March 1847	1·27 "

Sandwick Manse, Orkney.—March 1. Clear. 2. Clear: cloudy. 3. Clear. 4. Damp. 5. Damp: drops. 6. Damp: cloudy. 7. Cloudy. 8. Showers: clear: aurora. 9. Bright: showers. 10. Clear: hoar frost. 11. Cloudy: showers. 12. Bright: clear. 13. Clear: hoar-frost. 14. Cloudy: rain. 15. Bright: clear: aurora. 16. Showers. 17. Cloudy: showers. 18. Bright: cloudy. 19. Bright: clear: aurora. 20. Snow: clear: aurora. 21. Clear: frost: cloudy. 22. Clear: cloudy. 23. Rain: drops. 24. Clear: cloudy. 25. Bright: cloudy. 26. Rain. 27. Clear: fog. 28. Fog: rain. 29, 30. Bright: cloudy. 31. Clear: cloudy.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1848. March.	Max.	Min.		9 a.m.	9 p.m.	9¼ a.m.	8¾ p.m.	Max.	Min.		Max.	Min.	9¼ a.m.	8¾ p.m.								
1.	28·907	28·637	28·39	28·68	28·83	28·82	29·14	46	30	40·5	44	36	40	40	sw.	calm	nnw.	e.	·11	·15	......	·07
2.	29·540	29·106	28·80	29·13	29·58	29·45	30·22	46	36	41	47	34½	41	40½	nw.	nw.	n.	n.	·11	......	......	·35
3.	30·064	29·870	29·54	29·88	29·93	30·43	30·34	49	23	40	47	34½	42	33	n.	nw.	n.	e.	·03	·16	......	......
4.	30·122	30·000	29·77	29·94	29·73	29·85	29·69	48	32	36	47	29½	42	40½	s.	calm	sw.	se.	·04	......	......	......
● 5.	29·808	29·742	29·49	29·55	29·70	29·60	29·77	42	36	40	47	37½	41½	42	s.	e.	sw.	s.	·40	·09	......	·23
6.	29·859	29·787	29·52	29·73	29·60	29·83	29·72	46	28	39	45½	35	43	39	nw.	wnw.	sw.	se.	......	·20	......	·03
7.	30·177	29·797	29·53	29·74	29·98	29·78	29·91	46	22	39	46	35½	41	40½	e.	e.	ne.	sw.	......	......	......	......
8.	30·262	30·058	29·88	29·90	29·86	29·75	29·81	50	41	36	50	38½	44½	41	sw.	s.	w.	sw.	·02	......	0·50	·07
9.	29·960	29·654	29·55	29·64	29·23	29·50	29·13	53	36	49	51	42	46	42	w.	wsw.	sw.	sw.	·01	......	......	......
10.	29·449	29·391	29·00	29·10	29·10	29·21	29·07	49	38	41	45½	36	40	36	sw.	s.	wnw.	se.	·29	......	......	·07
11.	28·942	28·745	28·50	28·59	28·50	28·62	28·83	47	35	44	45	35	40½	37	sw.	w.	w.	e.	·20	·22	......	......
☽ 12.	28·909	28·697	28·34	28·10	29·04	29·03	29·25	44	34	42	44½	36½	40	38	nw.	nw.	nnw.	n.	·07	·08	......	·09
13.	29·471	29·204	28·85	29·25	29·50	29·45	29·62	44	36	38	47½	33½	41½	34	nw.	nnw.	nw.	......	·18	·10	......	·07
14.	29·874	29·758	29·44	29·69	29·60	29·61	29·44	49	24	41	46	28½	40½	39½	ne.	n.	nw.	w.	......	·04	......	......
15.	29·770	29·389	29·36	29·50	29·33	29·36	29·61	52	30	45	46½	36½	43	38	sw.	s.	wsw.	e.	·06	......	......	·14
16.	29·484	29·467	29·20	29·59	29·59	29·91	29·91	44	36	42	47½	34½	44	41	ne.	n.	ne.	n.	·26	·07	1·10	·04
17.	29·401	29·324	29·06	29·45	29·50	29·86	29·81	42	36	40	43½	39	39½	41	s.	e.	nne.	nne.	·15	·31	......	·03
18.	29·404	29·245	29·15	29·44	29·20	29·62	29·24	54	27	44	49	38	40	38	se.	e.	ne.	se.	......	·08	......	·08
○ 19.	29·174	29·035	28·82	28·91	28·74	28·93	28·81	53	29	40	44	34	42	40	sw	s.	s.	se.	·15	......	......	......
20.	29·005	28·910	28·66	28·74	28·74	28·69	28·85	53	30	40	43	29½	40	37	sw.	s.	s.	sse.	·36	·02	......	·62
21.	29·448	28·726	28·50	28·88	29·15	29·07	29·22	50	25	43	45	31½	41	39½	w.	se.	ne.nw	ese.	·08	·36	......	......
22.	29·638	29·574	29·26	29·37	29·16	29·42	29·39	56	47	40	46	27½	41½	40	sw.	w.	ne.	ese.	·02	·06	......	......
23.	29·860	29·670	29·16	29·18	29·50	29·33	29·68	58	44	50	50	42	41½	40½	sw.	sw.	sw.	ne.	......	·09	1·70	·09
24.	30·105	29·994	29·53	29·84	30·00	30·02	30·17	55	30	47·5	55½	44	45½	43½	nw.	w.	ne.	e.	......	......	......	......
25.	30·130	30·015	29·71	30·03	29·85	30·09	29·88	55	35	42·5	54	35	43½	42½	nw.	nw.	se.	sse.	......	......	......	......
26.	29·858	29·714	29·44	29·61	29·57	29·75	29·66	54	39	45	49	43	43	42	sw.	s.	w-sw.	se.	·05	......	......	·19
27.	29·669	29·655	29·33	29·55	29·55	29·70	29·80	57	40	47	47	40	44	39	sw.	s.	s.	se.	·24	·07	......	·40
☾ 28.	29·813	29·731	29·33	29·50	......	29·78	29·64	59	41	45	...	41	45	43	sw.	sw.	se.	ese.	·21	·20	......	·07
29.	29·899	29·824	29·46	......	29·60	29·69	29·54	61	32	46	45	...	46½	44	sw.	nw.	s.	s.	......	·30	......	·10
30.	29·831	29·760	29·40	29·60	29·65	29·56	29·72	62	39	50·5	56	33	46	44	s.	sse.	s.	w.	·01	......	0·80	......
31.	29·998	29·899	29·50	29·81	29·89	29·92	29·90	71	35	52	63	38	45	42½	s.	s.	sw.	sse.	......	......	......	·05
Mean.	29·672	29·492	29·21	29·410	29·440	29·536	29·573	51·45	33·74	42·8	47·9	35·9	42·40	39·95					3·05	2·60	4·10	2·79

THE ANNALS

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[SECOND SERIES.]

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XLII.—*On a proposed New Order of Gasteropodous Mollusca.* By Joshua Alder and Albany Hancock.

[With two Plates.]

At the last meeting of the British Association at Oxford we took the liberty of bringing under the notice of the Natural History Section two or three curious little mollusks, which had recently been found by our friend Mr. W. P. Cocks on the coast near Falmouth. These mollusks belong to a group very little known to British naturalists, but interesting on account of their zoological relations, and the modifications they show in the molluscan type. Want of time prevented our making our communication to the Oxford meeting so full as we could have wished, but having since had the opportunity of making further investigations, particularly with regard to their anatomical characters, we now offer our remarks on this group in a more detailed and somewhat amended form.

The three species which we then described we considered to be new. On showing our drawings to Dr. Johnston, however, he at once recognized our *Chalidis nigricans* to be his *Limapontia nigra,* a species which we had previously not been able to make out. There cannot be a doubt that our little animal belongs to the genus *Chalidis* of Quatrefages; these genera therefore must be synonymous; and as the name of *Limapontia* has precedence, it becomes necessary to adopt it. The description and figure published by Dr. Johnston in Loudon's 'Magazine of Natural History,' taken from a single specimen, did not give the characters so well as could be wished; it will, therefore, we trust not be thought superfluous if we redescribe and figure it on the present occasion, especially as this is the species upon which our anatomical details are founded.

LIMAPONTIA NIGRA, *Johnston*. Pl. XIX. figs. 4, 5, 6. Johnst. in Loud. Mag. Nat. Hist. vol. ix. p. 79.

Body black, or sometimes of a transparent brownish green, rather depressed, the sides slightly overhanging the foot. When in full progression the sides are almost parallel, but more frequently they are a little convex, and when the animal is at rest it becomes nearly circular. *Head* truncated in front and flat at the sides, where it is elevated into two crest-like ridges, arched from behind forwards. *Eyes* large, situated at the posterior extremity of the crests, in a pale circular space, which is prolonged on the crest. *Foot* of a yellowish colour, slightly stained by the viscera; narrower than the body; the sides are parallel, and it tapers gradually to a bluntish point behind; in front it is truncated with the angles rounded. Length $1\frac{1}{2}$ line.

A single specimen was obtained by Dr. Johnston in Berwick Bay; since which it has been found in great abundance by Mr. Cocks at Falmouth, in small pools among the rocks, between half-tide and high-water marks, feeding upon *Conferva glaucescens*. We have also got it in similar situations at Cullercoats, and Mr. Richard Howse has taken it at Whitburn.

The following observations on this species have been communicated to us by Mr. Cocks:—"They are found on *Conferva glaucescens*; they eat its branches and the microscopic larvæ with which the plant is infested. In July 1847 I procured a portion of the Conferva, not more than one inch in length and four-eighths in breadth, containing upwards of twenty patches of spawn; each patch contained from 50 to 150 ova. Stragglers are sometimes met with on the *Conferva albida*; but the spawn, never. I have found them in the shallow pools on the rocks at half-tide in the months of April, May, June, July, August, September, October, and November. In December I visited all my old haunts, but without success: the slugs had migrated, and the Conferva was in a decayed state or dead. In fine warm weather they congregate on the surface of the Conferva, but in dull, cold, or windy weather, they descend towards the lower portion of the plant. They are active, very hardy, and tenacious of life. I have kept them in bottles for a month or six weeks, without changing the water, with apparently very little injury."

They appear to be most plentiful during the months of June and July, at which time we met with them in great abundance at Cullercoats; but on visiting the same spot again in the autumn, not a single individual was to be found. It is probable that the old individuals die off during the winter, and the young brood do not come to maturity until the following year. Their remaining so much longer on the Cornish than on the Northumberland

coast may be accounted for by the difference of climate, as their position in shallow pools exposes them a good deal to change of temperature. The spawn forms a small pear-shaped, transparent, gelatinous mass (Pl. XIX. fig. 7), with the ova, which are yellow, imbedded in the centre. Some spawn, deposited by an individual, in a vessel of sea-water, on the 3rd or 4th of June, was hatched, and the larvæ swimming about on the 20th of the same month. The larva very much resembles that of the Nudibranchs, as may be seen by a reference to the figure (Pl. XIX. fig. 8), having, in that state, a transparent shell and an operculum, which afterwards disappear. A transparent and nearly colourless variety of *Limapontia nigra* is frequently found at Cullercoats, in which the green biliary organ is seen through the skin, as represented in Pl. XIX. fig. 5.

This species, when bruised, has a peculiar sweetish smell, like that of moist sugar, which appears to be derived from the Conferva it feeds upon.

In Lovén's 'Index Molluscorum Scandinaviæ' this species is made synonymous with *Planaria limacina*, O. Fabricius, and *P. capitata*, Müller. The former we can find no description of, but the *Fasciola capitata* of Müller (Verm. 70) may be either this or a nearly allied species. He describes it however to be spotted with white, which is scarcely a character of *L. nigra**.

Acteonia corrugata, n. s. Pl. XIX. figs. 2, 3.

Body limaciform, black, depressed, somewhat bulged at the sides, and covered with regular wrinkles like an *Arion*. On each side of the body there is a slightly elevated ridge, with a few pale tubercular spots. *Head* carinated at the sides; each carina being produced above into a short, flat, ear-like tentacular process, which is whitish. The *eyes* are placed in circular palish spots at the posterior extremity of the ridges. The posterior extremity is obtuse and pale; there is also a palish spot near the centre of the back. *Foot* linear. Length one-eighth of an inch.

Found by Mr. Cocks at Falmouth along with the last, and feeding upon the same Conferva, but rare.

The genus *Acteonia* was formed by M. de Quatrefages for a small mollusk found on the French coast. It comes very near to the last, the chief difference being in the form of the carinated ridges at the sides of the head, which in this are produced into flat, blunt, angular projections making an approach towards tentacles.

* Perhaps *Fasciola capitata* may be the black species of *Pelta*, described in the 'Ann. of Nat. Hist.' vol. xviii. p. 289, which agrees with Müller's description in having a ridge along the side, and is also sprinkled with pale spots.

Genus Cenia*.

Animal limaciform; the back elevated; head slightly angulated, and bearing two linear tentacles on the dorsal aspect, behind and exterior to which are the eyes. Anus a little behind the centre of the back.

Cenia Cocksii, n. s. Pl. XIX. fig. 1.

Body robust, considerably elevated on the back; black above, fading into fawn-colour at the sides. *Head* slightly angulated at the sides, and having a black central stripe, the sides of which, as well as the tentacles and the area surrounding the eyes, are yellow or fawn-coloured: on each side of the back, near the region of the anus, is a slight ridge with three or four pale tubercular spots. *Tentacles* of moderate length, cylindrical and linear; the points obtuse. *Eyes* very large. Length three-sixteenths of an inch.

Two or three specimens were found at Falmouth by Mr. Cocks on *Chorda lomentaria* and *Dumontia filiformis*, in pools between tide-marks.

We dedicate this species to its discoverer, whose exertions have added many species to the different departments of the British fauna.

These animals have been placed by M. de Quatrefages in his order *Phlebenterata*, which, it will be recollected, is formed by detaching the *Eolididæ* from the other *Nudibranchiata*, and uniting them with these to form a new order, founded upon the gastric, or, according to that author's views, the gastro-vascular system of organization. This order we have already objected to, both on account of our opinion of the incorrectness of the theory which the name involves, and because it breaks up the order *Nudibranchiata*, which appears to us to be a natural group, well-distinguished by their external characters, and, though somewhat different in their internal anatomy, showing modifications, in that respect, so gradual that it is scarcely possible to draw a line of distinction which would separate them even into families. M. de Quatrefages seems now inclined to give up this group as an order, but thinks it convenient to retain it as a section of the *Nudibranchiata*. We cannot, however, agree in any arrangement that would bring the *Eolididæ* into closer relationship with these little animals than with the other families of the *Nudibranchiata*; nor do we think that these animals can with propriety be referred to

* In our communication to the British Association we proposed the name of *Ictis* for this genus, but having since found that this name is already appropriated to a genus of *Mammalia*, we have now changed it to *Cenia*, an ancient name of the place near which it was found.

an order, so remarkable for the beauty and variety of the branchial appendages with which the species are adorned. The mollusks now under consideration are, on the contrary, distinguished by the extreme simplicity of external form, and by the absence of any specialized breathing organs. It would, therefore, be more in conformity with the views on which the existing orders of *Gasteropoda* were established by Cuvier, to consider this group as forming a separate order, characterized by the absence of specialized branchiæ; and as the function of respiration is entirely performed by the skin, we propose to call this order Pellibranchiata, and to include in it the following genera:—

Elysia, Risso (*Actæon*, Oken).

Limapontia, Johnston (*Chalidis*, Quatrefages).

Acteonia, Quatrefages.

Cenia, Alder and Hancock.

The *Placobranchus* of Van Hasselt, a genus involved in great obscurity, may possibly belong to this order, as it has a very evident relationship with *Elysia*; but, as it is stated to have lamellated branchiæ, disposed on the back and lateral lobes, we think it more probable that it is an aberrant group of the *Nudibranchiata*, forming a passage to the present order through the genus *Elysia*, the latter being itself a slight departure from the more simple form of the *Pellibranchiata*.

On the other hand, this order is nearly allied to the *Inferobranchiata* through a small mollusk which we have already described in the 'Annals of Natural History*,' having very much the form and appearance of the *Pellibranchiata*, but possessing external plumose branchiæ, under the right side of the cloak, as in the former order, to which it must consequently be referred. This animal we take to belong to the genus *Pelta* of Quatrefages, though the characters he assigns to that genus differ in many respects from those we find in our species.

In consequence of the extreme degradation from the molluscan type that M. de Quatrefages has stated to exist in these little animals, they have become objects of much interest in a physiological point of view, and we therefore consider ourselves fortunate in having the opportunity of examining two or three of the genera, and especially in having got one of these in such great abundance, as, notwithstanding its minuteness, to enable us to make out its anatomy very satisfactorily. The anatomy of this species (*Limapontia nigra*) we now purpose giving in detail, and from the slight examination we have been able to make of the other two genera, species of which we have described, we believe it may be taken as a fair example of the anatomical characters of the order;

* Vol. xviii. p. 289.

and as the species subjected to dissection is one of the most simple forms of the group, it is consequently likely to show any departure from the molluscan type in the greatest degree. It will be seen, however, that no such extreme degradation as that supposed to exist by M. de Quatrefages, is to be found in our little mollusk, whose organization, though showing some interesting modifications, agrees upon the whole with that of the other Gasteropods.

Anatomy, by Albany Hancock.

In describing the anatomy of these animals we shall confine ourselves almost entirely to that of *Limapontia nigra,* as of it alone have we possessed a sufficient number to warrant our entering at all into details on the subject. We would premise, however, that on account of the extreme minuteness of this species, we have been compelled to use the compressor, and to rely on this mode of investigation to a considerable extent. Being fully aware of the danger arising from examinations conducted solely by the aid of transmitted light, especially on animals so highly organized as the *Pellibranchiata,* we have taken every precaution to avoid error; and having had an exhaustless supply of specimens, we have verified most of the points over and over again. To prevent the confusion arising from the multiplicity of parts, we soon found it necessary to separate the viscera, and it was not until we succeeded in doing this that we made out the generative system, which is of vast complication in this animal. The digestive apparatus is much simpler, and may be almost entirely determined without the aid of the compressor. We observed nearly the whole of this portion of the anatomy in an individual whose skin was rendered transparent by removing the epidermis and pigment cells: the œsophagus and intestine, being filled at the time with matter, rendering these parts opake, were seen very distinctly; the two lateral branched vessels forming the biliary organ were also observed in connexion with the sides of the stomach.

We have said thus much on the mode of investigation, that the authenticity of the following details may be duly estimated.

The Digestive System opens on the inferior surface of the head, where a small puckered orifice indicates the entrance to a short channel, which leads to a muscular buccal mass (Pl. XX. fig. 1 *a*). This is circular when viewed from above, but, when seen in profile, is irregularly quadrate, with a projection in front from the inferior angle. We could not distinguish the least appearance of corneous jaws. The tongue (*b*) however is very easily seen: it is a prehensile organ, and appears to be placed in the cavity of the mouth as in the *Eolididæ*; that is, it is bent fr m behind

forwards and supported in the centre of the cavity on a fleshy arch. When seen in the compressor, it is always doubled near the middle, as may be observed in *Eolis* under the same circumstances. It is composed of ten or twelve plates or joints, each bearing a large crystalline spine, or rather process, apparently of a flattened or scoop-like form. These spines or processes are directed backwards to the œsophagus. In connexion with the anterior, or outer extremity of this prehensile organ, is placed what might be taken for an oval sac (figs. 1 *c* and 2 *a*), containing spines, much resembling those of the tongue, but smaller. Professor Allman has pointed out in *Actæon* an appendage of the same kind, and supposes it to be a vesicle for the purpose of generating the spines of the tongue. In two or three species of the *Polycerinæ*, as well as in some species of *Doris*, we have observed a similar organ, and have ascertained that in these species it is not a vesicle but a portion of the channel of the mouth, immediately in advance of the tongue, having the interior lined with rows of minute spines, forming, in fact, a prehensile collar, which on being everted forms a circle of curved spines, directed inwards, so as to lay hold of the food and carry it backwards to the tongue, which immediately conveys it to the œsophagus. In *Actæon* and *Limapontia* there can be little doubt that this sac-like appendage is an organ for the same purpose, though, on account of the minuteness of the species we have examined, we should have found much difficulty respecting it but for the homology above alluded to. Be this, however, as it may; judging from analogy, this sac-like appendage cannot be for the purpose assigned to it by Professor Allman, for the spines of the tongue are generated at the opposite extremity, as any one may convince himself by viewing the tongue of *Purpura* or *Buccinum*, when the spines will be observed at the *inner* extremity in a state of growth, apparently soft and not perfectly formed.

Immediately in front of the buccal mass, and probably connected with the channel of the mouth, is a folliculated organ (fig. 1 *d*), which, perhaps, from its position and character, may be considered a salivary gland.

The œsophagus (*e*) is a long, slender tube, passing from the posterior part of the buccal mass near the inner termination of the tongue, and ending about the centre of the body, where it dilates gradually into a stomach of no great size (*f*); but whose entire configuration we could not determine, having only seen its anterior portion, the rest being overlapped by the opake granular substance of the hepatic organ.

The intestine (*h*) is short and slender: it arises from the left side of the upper surface of the stomach, and, taking a sweep

backwards and towards the right side, ends in the anus (i), which is median, and a little behind the centre of the body.

At first we could scarcely determine the position of this organ, though we had traced the intestine almost to its termination; and, notwithstanding that there is at this part of the back a swelling indicating its presence, yet there is no prominent nipple, and it is very difficult to see the opening. The position of the anus however was made manifest by our observing excrementitious matter passing out of it, and its situation cannot therefore be doubted. We succeeded in gaining further proof of the position of this excretory orifice by using the compressor, so as to force the contents of the intestine through it. This was attained by placing the animal in the instrument with its dorsal ridge exactly in profile, and then adjusting the pressure, with great care, to avoid rupture. In this way we, more than once, forced out the contents of the intestine.

Along each side of the back immediately below the skin, and distinct from it, is a wide, somewhat folliculated, and branched vessel (g, g, g, g), having the interior lined with a layer, more or less thick, of dark green granules. These vessels are joined to the sides of the upper surface of the stomach, which is nearly covered with the granular substance. In these vessels we think we perceive the true homologue of the liver of the more typical mollusks; and in proof of this opinion we would refer to the nature of their contents, which, as just stated, are green and granular. When these granules are highly magnified, each is found to be an aggregation of very minute corpuscules within a delicate membranous vesicle, having much the character of the microscopic structure of the glands of the papillæ of *Eolis*.

In *Cenia* and *Acteonia* the digestive system would appear to be similar to that of *Limapontia*; both are furnished with a muscular buccal mass without jaws, but having a lingual apparatus formed as in *Limapontia*; the hepatic organ has the same disposition as in that genus; and the anal aperture in both is indicated by a slight swelling on the median line near the centre of the back, though we have not determined its position in these two genera with the same precision as in *Limapontia*.

This account of the alimentary system is very different from that given by M. de Quatrefages in the description of his *Chalidis cærulea*. The anus and intestine he has altogether overlooked, and the two lateral hepatic vessels he has called the stomach, that organ having likewise escaped his observation: there can be no doubt, however, that *C. cærulea* is as highly organized as *L. nigra*.

The Generative System lies immediately beneath the organs

of digestion, and is highly complicated and of great extent, filling by far the largest portion of the body. Each individual possesses both male and female organs, as well as the additional apparatus of a spermatheca, as observed in the Nudibranchs. The external orifices are placed on the right side of the body and are three in number; two immediately below the eye, and one nearly half-way along the body. Of the two anterior orifices, the one in front is that of the male intromittent organ (Pl. XX. fig. 4 *a*), and the other, which is close behind it, is that for the passage of the ova (*l*); the third orifice (*m*) is in communication with the spermatheca, and is that by which impregnation is effected. Of the position and nature of these orifices there can be no doubt, for we have had frequent opportunities of observing the animals during *coitus*, and have also seen them when spawning. The male intromittent organ lies doubled upon itself immediately within the orifice, and when partially exserted (fig. 4 *a*) is of a subconic form, but is capable of much elongation and attenuation. The point (figs. 4 *b* & 5 *b*) is furnished with a minute curved crystalline spur-like process, which is perforated (fig. 6 *a*). The base of this process is united to a tube (figs. 4 *c* & 5 *c*), which, passing through the axis of the penis, runs a short way backwards and is joined by the oviduct at *j*, immediately after it is united to the duct of the testis at *g*, and then terminates in an elliptical bulb (*p*) at the end of the copulatory passage, just where it receives the duct of the spermatheca (*r*). Near to the point where the oviduct joins this tube, it is attached to what occasionally assumes the appearance, in the compressor, of two elongated glands (*m*) with undulated walls, but which is very possibly a portion of the large mucous gland belonging to the female parts, afterwards to be more fully described. In tracing the male organs backwards, it is seen that the duct of the testis, after its union with the tube of the penis, runs for a short way parallel to the copulatory channel, as will be by and by more particularly mentioned; and after communicating with it at *f*, soon reaches the median line of the body, about midway between the head and the tail. The duct of the testis then suddenly dilates, and, almost directly afterwards, divides into two branches, one going to each side of the body (*d d*); here these branches again divide into two nearly equal portions, one of which goes towards the head, the other towards the tail; these portions divide and subdivide two or three times, the extremities ending in blind sacs. This multiple organ, there can be no doubt, is the testis, though we have no direct evidence in proof of this. Its anatomical relationship, however, appears sufficient to warrant this opinion.

The ovarium (*h' h h*), like the testis, is also divided into two parts; one, much the larger (*h h*), occupies the posterior portion

of the body; the other (h') lies on the left side immediately behind the buccal mass, and extends backwards as far as the middle of the body. This organ is composed of large globular vesicles of a yellow colour, six of which make up the posterior, and four the anterior portion. The ova are generated in the interior of these vesicles, which are united by short ducts into pairs; each pair having a single channel of communication with the central duct. Thus it would appear that the ovary as well as the testis has a dichotomous arrangement. The channels of the two portions of the ovary are united near the median line of the body, a little in front and to the left of the union of the two divisions of the testis; and almost immediately after their junction, the common oviduct, passing towards the right side, is suddenly enlarged and doubled once or twice upon itself (i); it is then as suddenly constricted, and shortly afterwards reaches the tube of the penis at j, just in advance of its union with the testis, as before stated. At this point the tube of the penis is attached to the upper surface of a large pellucid gland (k), which lies along the right side of the body, extending from the base of the penis to the orifice leading to the spermatheca. The colour and general appearance of this organ resembles that of the mucous gland of *Eolis*, and like it, no doubt, secretes the transparent jelly-like envelope that covers the eggs. This gland is of an irregular form, but neither its shape nor general structure could be determined with precision, on account of the distortion produced by the compressor. The opake granular portion associated with this gland in *Eolis* would appear to be wanting, unless the two glandular-like organs (m), before noticed in connexion with the tube of the penis, are the homologues of this part, which we are rather inclined to think is the fact.

The mucous gland terminates in front in a widish channel which opens externally (l) immediately behind the base of the penis. It is through this opening that the spawn, as before stated, issues from the body; but we have not been able to ascertain how the eggs reach this channel: most probably the oviduct, shortly after its junction with the tube of the penis, sinks down into the channel of this gland; and thus, as in *Eolis*, the passage for the eggs is accomplished. Whether this be the mode of communication or not, it is certain that the eggs find their way into the channel and anterior portion of the mucous gland, for we have had ocular proof of the fact. On one occasion, observing an individual spawning, we placed it in the compressor, and detected numerous ova, as described, in the anterior portion of the gland and also in the channel: a little more pressure forced them out at the orifice.

The spermatheca (q) is an oval sac of considerable size and of

a brownish yellow colour. It lies a little behind the buccal mass, near the median line of the body. From its right side issues a small duct (*r*), which, turning backwards, communicates with the bulb (*p*), or dilated portion of the copulatory passage, at the point where it receives the tube of the penis. From thence the copulatory passage or channel (*o*) leads backwards, and for a short way runs parallel to the duct of the testis, to which it is closely adherent; it soon contracts and turns to the right side. At the point where the contraction takes place it communicates at *f* with the duct of the testis; afterwards the walls of the channel continue parallel until it approaches the external orifice, when it suddenly expands into a sort of shallow pouch (*n*). During copulation, the intromittent organ, entering at this orifice, will pass along the channel just described, probably as far as the bulb, or dilated portion, in connexion with the short duct of the spermatheca; from thence the seminal fluid will readily reach that vesicle, to be there retained until required for the fertilization of the ova. How this takes place will be seen if we trace the eggs from the ovary to the external outlet.

The eggs pass from the ovigerous sacs by the small ducts before described, and, reaching the central duct, find their way at once into the dilated portion (*i*) of the common oviduct; and there, probably, are advanced another step towards maturity: they then pass along the constricted part of the oviduct, and reach the tube of the penis near its junction with the bulb of the copulatory passage, when they will be within the influence of the fluid stored up in the spermatheca, and also of that of the testis of the same individual. The bulb (*p*), or dilated portion of the channel leading to the spermatheca, may be probably a sort of reservoir for the retention of the fertilizing fluid secreted by the testis of the same individual. If so, this fluid may be supposed to pass from the duct of the testis at the point (*f*) where it communicates with the swelled portion of the channel, and it may be here that the eggs are fertilized. During coitus the seminal fluid will pass directly onwards through the duct of the testis to the tube of the penis. And thus, perhaps, we arrive at a correct understanding of the function of those two points of union. The eggs, after being thus fertilized, pass downwards into the channel of the great mucous gland (*k*), and then become enveloped in their final covering previous to expulsion through the opening (*l*) at the base of the penis.

It would appear, from the diagram of *Chalidis cærulea* given by M. de Quatrefages, that he has confounded the ovary with the testicle, and that which is called the testicle is probably a portion of the great mucous gland. The salivary gland has the

appearance of the spermatheca. Further than this, these organs seem to have escaped observation.

In *Cenia* and *Acteonia* we have not been able to investigate the reproductive organs; they both, however, have the intromittent organ provided with a curved crystalline spur-like point.

The generative system of *Actæon* (*Elysia*), as given by Professor Allman, appears to have a considerable resemblance to that of *Limapontia*. We think we can recognise the same parts, though Professor Allman differs from us in assigning to them their various functions. To arrive at a just conclusion on this difficult subject, it is necessary, in the first place, to ascertain the position of the external orifices, and their connexion with the several parts of these complicated organs. Unfortunately in *Actæon* these points could not be determined. In *Limapontia*, on the contrary, we have had the good fortune to succeed in making them out with sufficient certainty; consequently we have been able to speak with more confidence than we should have otherwise done. The large irregularly-formed organ in *Actæon*, which is designated *testis*, is undoubtedly the same that we consider the mucous gland. The opening of the gland externally, and the detection of eggs in the anterior portion of it and in its channel, are sufficient to prove that this cannot be the male secreting organ. If then this be the mucous gland in *Actæon*, the testis must be sought for elsewhere. It seems to have escaped notice. The vas deferens, however, has been traced backwards until it bifurcates near the median line of the body in the same way as it does in *Limapontia*. Here, therefore, judging from analogy, the testis begins; and it will probably be found occupying a position in the neighbourhood of the ovary. The oval pouch (y) is most likely the homologue of the dilated portion of the common oviduct, and the small tube that passes from it backwards, dividing dichotomously, will prove, very probably, to lead from the ovarium. The oval body (x), we would surmise, corresponds with the dilated portion of the copulatory channel at the base of the spermatheca; like it, it is in communication with the vas deferens, or testis, and with the oviduct; and, if this conjecture be correct, it will also communicate with the oval sac which we take to be the spermatheca: it will likewise have an external outlet.

From the description we have given of the reproductive system of *Limapontia*, it is evident that it does not differ in any material degree from what has been observed in the Nudibranchs.

The ovary and testis are certainly considerably modified, and are differently arranged in the body; their ducts, however, and the duct from the spermatheca, as in *Eolis*, are all brought

together on the superior wall near to the channel of the great mucous gland, and then communicate with each other. Hence the inference that the eggs may possibly receive the fertilizing influence of two individuals, as we suppose to be the case with the Nudibranchs. The most interesting modification of these organs is in the position of the external orifices. In *Eolis* all these three are placed close together within a common opening: in *Limapontia,* as before described, the orifice leading to the spermatheca is removed to a considerable distance from the other two. The nature of these orifices becomes therefore better understood. From this arrangement we have been enabled to determine beyond a doubt, that the channel leading to the spermatheca is really the copulatory channel, and that the orifice at the base of the penis is that through which the eggs pass; and thus the anatomy of this animal becomes confirmatory of our views, elsewhere expressed, of these parts in *Eolis.*

Vascular and Respiratory Systems.—From the minuteness of the species on which our observations were made, we have not been able to trace the former system to any great extent. The heart, however, we have determined with sufficient precision: it is composed of two distinct chambers,—a ventricle and an auricle. These may be seen by placing the animal sideways in the compressor. We succeeded in this way, after having made several fruitless attempts in the usual manner, of depressing the animal with the back uppermost. In the more transparent individuals the heart may be observed beating near the middle of the back, within an indistinct, irregular, oval swelling, without the aid of the compressor; but the best way of ascertaining its parts is that, above-mentioned, of compressing the animal sideways, and thus obtaining a profile view of the heart. In this position the two chambers are rendered quite obvious. They lie immediately below the skin, within a clear space, which perhaps indicates the extent of a pericardium. The ventricle is placed in advance of the auricle, and is pyriform, with the apex in front; the auricle is a little larger than the ventricle, and is separated from it by a very marked constriction: its form resembles that of the ventricle, but is a little narrower and has the attenuated end posterior; this end terminates in a well-defined vascular trunk, which appears in close contact with the skin. By adjusting the pressure so that, when the parts are rendered sufficiently transparent, the heart is permitted to swell and contract, the blood may be seen passing along the aorta, which issues from the anterior apex of the ventricle. In this way we could trace the aorta as far as the buccal mass, where it bifurcates. On leaving the ventricle it dips a little downwards, and then advances towards its destination.

Further than this we have not been able to make out the vascular system.

When subjected to the pressure of the instrument, the pulsations of the heart are very slow, but when the animal is at liberty it beats with great rapidity,—probably ninety times or even more per minute. We could not ascertain the number exactly on account of the restlessness of the little creature, and the impossibility of seeing the pulsations excepting in some particular lights.

M. de Quatrefages describes his *Chalidis cærulea* to be without a heart or any traces of a vascular system. We have seen that *Limapontia nigra* possesses not only a well-formed bipartite heart, but that it has also an arterial system, and from the sudden contraction of the auricle behind it, it is evident that the venous system is not altogether deficient, or that portion of it, at least, which M. Milne-Edwards calls branchio-cardiac. The deductions of M. de Quatrefages therefore, in this instance, cannot be sustained.

Respiration appears to be performed by the whole surface of the body, as it is entirely clothed with vibratile cilia, not even excepting the under surface of the foot*. The cilia are large and vigorous, and their action may be detected under favourable circumstances with a powerful single lens.

Nervous System and the Senses.—We have not paid sufficient attention to this part of the subject to enable us to give a detailed account of its anatomy. The cerebral ganglia were consequently not fully determined: they are placed as usual round the commencement of the œsophagus, and are four or more in number. The central or upper pair are somewhat pyriform, and are placed further apart than usual: they are connected by a stout commissure. The lateral pair are rather smaller than the central ones, and are of an elliptical form: they appear to be united below the œsophagus by a short collar and two small oval buccal ganglia; but these were not determined with sufficient certainty. Nerves pass from these central ganglia to all parts of the body.

The optic nerve is of considerable length, and springs from the outer margin of the central ganglion, where it joins with the lateral one. This nerve enters the base of the black pigment cup of the eye, which is large and pretty regularly formed. Half-buried within the mouth of this cup is a spherical crystalline lens, which is protected in front by a cornea, that passes close in advance of it: the whole is enveloped in a thin membranous sac.

* *Limapontia* is not, by any means, the only slug that has the under surface of the foot ciliated. We have detected these minute organs on the same part in the Nudibranchs, and in *Purpura*, *Littorina* and *Patella*. It is therefore probable that all the Gasteropods have cilia on the crawling disc.

The auditory capsule contains a single spherical otolithe, and is attached to the central ganglion at the root of the optic nerve.

In *Acteonia corrugata* the auditory capsule is also furnished with a single otolithe.

EXPLANATION OF PLATES XIX. AND XX.

Plate XIX.

Fig. 1. *Cenia Cocksii*, much enlarged.
— 2. *Acteonia corrugata.*
— 3. Side view of the head of the same.
— 4, 5, 6. Different views of *Limapontia nigra.*
— 7. Spawn of the same magnified.
— 8. Larva of the same.
— 9. A portion of one of the lateral hepatic trunks of *Cenia Cocksii*, showing its granular appearance.
— 10. A few of the granules more highly magnified, exhibiting their minute structure.

Plate XX.

Fig. 1. General view of the digestive system of *Limapontia nigra*: *a*, buccal mass; *b*, tongue; *c*, prehensile collar in advance of the same; *d*, salivary gland; *e*, œsophagus; *f*, stomach; *g g g g*, lateral hepatic trunks; *h*, intestine; *i*, anus; *j*, cerebral ganglions.
— 2. Tongue removed from the buccal mass: *a*, prehensile collar.
— 3. Two joints or plates of the tongue more highly magnified.
— 4. General view of the reproductive system: *a*, penis; *b*, crystalline point of the same; *c*, tube of the penis; *d d*, testis; *e*, duct of the same; *f*, junction of the duct of the testis with the bulb of the copulatory channel; *g*, junction of the duct of the testis with the tube of the penis; *h h h*, ovigerous sacs containing ova; *i*, dilated portion of the oviduct; *j*, junction of the oviduct with the tube of the penis; *k*, mucous gland; *l*, external orifice leading to the same, and through which the eggs pass; *m*, two elongated glands probably connected with the mucous gland; *n*, shallow pouch at the external orifice leading to the spermatheca; *o*, copulatory channel; *p*, bulb of the same; *q*, spermatheca; *r*, duct of the same.
— 5. Intromittent organ of *Limapontia nigra*: *a*, penis; *b*, crystalline point; *c*, tube.
— 6. Crystalline point (much magnified) of the penis of *Cenia Cocksii*, exhibiting the perforation at the extremity *a*.
— 7. Profile view of the heart of *Limapontia nigra*: *a*, ventricle; *b*, auricle; *c*, aorta; *d*, venous trunk leading to the auricle; *e*, dorsal skin; *f f*, clear space, probably showing the limits of a pericardium.
— 8. Cerebral ganglions of *L. nigra*, with nerves: *a a*, central ganglions; *b*, commissure uniting the same above the œsophagus; *c c*, lateral ganglia; *d*, buccal ganglia; *e e*, eyes; *f f*, auditory capsules.
— 9. Auditory capsule, with otolithe, more highly magnified.
— 10. Eye greatly magnified, exhibiting the nerve, pigment cup, lens, cornea, and general capsule.

XLIII.—*Notes, &c. on the genus of Insects* Anthonomus; *with a description of one new species.* By John Walton, F.L.S.

Fam. CURCULIONIDÆ.

Genus Anthonomus, *Germ., Schönh., Steph., Curt.*

There is the greatest imaginable confusion amongst the species of this very pretty and interesting genus of insects; ten have been catalogued and described as specifically distinct, but I must confess my inability to distinguish out of that number more than four; notwithstanding all the care I have taken, it is very possible I may have erred or blundered; should this be the case, I must plead the infirmity of human judgement, from which the most skilful cannot claim exemption, and I can only say I shall feel truly obliged if any entomologist will have the kindness to point out any errors I may have inadvertently committed, and thus give me an opportunity of correcting them before the conclusion of my notes on this family of insects.

§ A. *Anterior femora strongly dentate.*

1. *Anthonomus Pomorum*, Linn. sec. ej. Mus. et Auctor. alior.
— *incurvus*, Steph. sec. ej. Mus., non Panz.

There are foreign specimens of *Ant. incurvus* in the collection of Kirby from Gyllenhal, and others in my possession from Schönherr; it is a small insect (length $1\frac{1}{2}$ line), about one-third the size of *Ant. Pomorum*, from which it only differs by being much less and inhabiting a different plant; according to the opinion of Gyllenhal, 'scarcely a distinct species,' and to Germar, 'obsoletely distinct;' in Sweden it inhabits the bird cherry (*Prunus Padus*), and possibly may be found on that plant in this country, where it grows wild in the mountainous districts of the north of England and in Scotland. I have not yet seen an indigenous specimen.

I may refer to some very interesting observations relative to the habits and œconomy of *Ant. Pomorum* in Mr. Curtis's 'British Entomology,' vol. ii., and in the 'Ent. Mag.' vol. i. p. 33.

Found on the blossoms of the apple- and pear-tree from about the 25th of May to the 15th of June, and under the bark in winter; the late Mr. Bainbridge reared many specimens, either from the larvæ or pupæ, I forget which, obtained from the buds or the rust-coloured blossoms of the apple.

2. *A. Ulmi*, DeGeer, Marsh., Gyll., Steph., Schönh., Kirb. MSS.
— *pedicularius*, Germ. Mag. iv. p. 322.
— *Druparum* var., Steph. sec. ej. Mus., non Linn.
— *fasciatus*, Kirb. MSS.

The form, sculpture, and general habit of this insect approxi-

mate very closely to the following, and being subject to considerable variation of size and colour, its varieties, without a careful comparative examination, are extremely liable to be mixed, as I have noticed in many cabinets, with the next species; it may however be satisfactorily discriminated by its having the rostrum evidently longer, more slender, with the antennæ inserted further from the apex; the tooth of the anterior femur distinctly longer and more robust; the basal half of the tibia curved and more dilated within in the middle; the posterior femora each with their tooth excessively minute, and scarcely perceptible without a powerful lens.

There are foreign specimens of *Curc. Druparum* in the Linnæan and British Museums, in the collection of Mr. Kirby from Gyllenhal, and in my possession from Schönherr: *Curc. Druparum* is incorrectly recorded to have been found near London and in Somersetshire, but a variety of the insect now under consideration appears to have been mistaken for it, nor has it hitherto been discovered as an inhabitant of this country; in Sweden it occurs copiously on the leaves of the bird cherry, and will probably be found in Britain if that plant is diligently searched.

Found plentifully on the leaves of elms (*Ulmus campestris*) near Gravesend in July, and in many other localities throughout Great Britain, but never, as far as my experience goes, in company with the following.

3. *Anthonomus pedicularius*, Linn. sec. ej. Mus., Marsh., Kirb. MSS., Steph. Ill.
Curc. fasciatus, Marsh.
Rhynch. Ulmi var., Gyll., var. γ. Schönh.
A. Pomonæ, Germ. Mag. iv. p. 323.
— *Pomorum*, Steph. sec. ej. Mus.
— *Ulmi* var. ?, Steph. sec. ej. Man.
— *maculosus* et *rubrescens*, Kirb. MSS.

I have frequently examined the insect in the cabinet of Linnæus labelled '*pedicularius*,' which agrees with his description, and which is, beyond all doubt, specifically identical with this insect; I have therefore followed Marsham and Kirby in adopting the name given by that illustrious naturalist.

Much doubt has hitherto existed as to the distinction of this from the preceding insect: Gyllenhal, Schönherr and Stephens think they are the same; whilst Marsham, Kirby, Germar and Curtis have separated them into distinct species, but without distinguishing characters: it appears that Gyllenhal, from his descriptions of the varieties of colour, has confounded this with the preceding insect, and that by depending too much on the inconstant character of colour he has overlooked specific differences

which are constant. I have a Swedish insect sent me by Schönherr as *Ant. Ulmi* var. γ, which undoubtedly belongs to this species, and which it is evident he has also confounded with the preceding.

Exclusively of colour, it may at once be distinguished by a comparative examination of the following characters: the rostrum is shorter, thicker, and the antennæ inserted nearer the apex; the tooth of the anterior femur evidently shorter and not so stout; the tibia of a different form, being nearly straight, except at the base which is a little bent, and much less dilated within in the middle; the posterior femora each with the tooth larger, and distinctly visible with a lens of an inch focus.

I have found this insect on the leaves of the white-thorn (*Mespilus Oxyacantha*) in hedges on the west side of Turner's Wood, Hampstead, sparingly in April of dark colours, and abundantly in September of pale colours; and also in many other localities in the south of England, but never on any other plant, or in company with *Ant. Ulmi*.

§ B. *Femora minutely dentate.*

4. *Anthonomus pubescens* ?, Payk., Gyll., Germ., Schönh.

Ovate, testaceous, cinereo-pubescent. Head small, round, testaceous, punctulated and pubescent; eyes globose, brown-black; rostrum rather longer than the head and thorax, slender, a little curved, punctulated, deep rufous, shining, and more or less fuscous at the apex. Antennæ rather long, slender, rufo-testaceous, clava elongate and fuscous. Thorax transversely impressed and constricted anteriorly, a little rounded at the sides, bisinuated at the base, moderately convex above, testaceous, closely and deeply punctured and pubescent. Scutellum small, elevated and densely pubescent. Elytra ovate, very convex above, testaceous, deeply punctate-striate, interstices narrow, convex, indistinctly punctulated and sparingly pubescent. Legs long, testaceous; anterior femora minutely dentate, posterior femora scarcely or very obsoletely dentate. Length $1\frac{2}{3}$ line.

The form of the rostrum, with the place of insertion of the antennæ, and the form of the tibiæ, are very similar to *Ant. pedicularius*; but the absence of a fascia on the elytra, and the minute tooth on each of the femora, at once distinguish this insect from the pale varieties of the two preceding, to which it is allied.

This insect agrees in all its essential characters with Gyllenhal's description of *Rhynch. pubescens*; there is however a difference in the colour of the head, that of the former being testaceous, and of the latter black or fuscous; but colour is so extremely variable in these insects that I consider it of very little value as a subsidiary specific character.

Three specimens of this, with other British insects, taken in Herefordshire by Mr. Doubleday, were given by him to Mr. Smith, one of which was kindly presented to me by the latter gentleman: it occurs on pines in the north of Sweden.

5. *Anthonomus Rubi*, Herbst, Gyll., Germ., Steph., Schönh.
Curc. ater et *melanopterus*, Marsh. sec. Mus. Steph. et Kirb.
A. obscurus var., Steph. sec. ej. Mus.
— *brunnipennis* var., Curt. Ann. Nat. Hist. v. 280.

This insect greatly varies in magnitude (length $1\frac{1}{3}$—2 lines) and in colour, which two circumstances have led to its being separated into different species: the varieties may be subdivided as follows:—

a. Black, with the basal joint of the antennæ, the base and apex of the femora, the tibiæ and tarsi fusco-piceous or fusco-ferruginous: *Curc. Rubi* of Herbst, and *melanopterus* of Marsh.: very common.

b. Entirely black; or black, with the basal joint of the antenna fusco-piceous: *Curc. ater* of Marsh.: not uncommon.

c. With the head, rostrum and thorax piceous black or piceous; the elytra and legs fusco-testaceous or fusco-ferruginous: *Ant. obscurus* of Steph., and *brunnipennis* of Curt.: not of frequent occurrence.

I have examined the original specimen of *Curc. clavatus* of Marsham in the cabinet of Mr. Stephens, and I have no doubt it is a large female specimen of *Balaninus* (*Rhynch.*) *Brassicæ* of Fab., with the apex of the rostrum morbidly tumefied and the palpus exposed*: Mr. Curtis gave me a specimen of *Ant. brunnipennis*, which I sent to M. Schönherr, who returned it as a variety (γ) of *Ant. Rubi*, accompanied by Swedish examples which agree with it: there are similar specimens of this variety in the cabinet of Mr. Stephens, under the name of *Ant. obscurus*, which I have carefully examined, but not being able to discover sufficiently distinctive characters, I am compelled to consider them, as well as *Ant. brunnipennis*, merely as immature varieties.

Widely dispersed throughout Great Britain, and found on various plants in many localities.

* I beg to return my sincere thanks to Mr. Stephens, not only for the invaluable privilege of inspecting his rich indigenous collection of insects (that of the late Mr. Marsham being now incorporated with his own), but for the facilities he has invariably afforded me in examining its rarities, which have been the means of enabling me to rectify many mistakes, originating in most cases from the great difficulty of distinguishing species from varieties.

XLIV.—*Some Notes on the Botany of Sinde.* By Captain N. Vicary, 2nd European Regiment *.

The following notes have been made from plants, collected under considerable difficulties, at seasons (Dec., Jan., Feb.) the worst that could be selected for collecting plants, or when I was accompanying an army in an enemy's country, with scarcely the means of transporting my private baggage. I mention this merely to show that much remains to be done of botanical interest in Sinde, and that my collection gives but a limited, although a characteristic idea of the plants that flourish in that region. The flora of Sinde falls naturally into three divisions, that of the hills, the plains, and the coast. The hills, being either the bases or outliers of the Hala range, are barren in the extreme, owing to the want of rivers, the rareness of natural springs, their saline nature where they do exist, and the absence of periodical rains.

Little that could be called soil exists; a few of the intervening valleys only are favoured with arable land.

The hilly country generally presents a most desolate and barren appearance—little vegetation meets the eye—scarcely anything but the bare, broken, pale or rusty yellow tertiary strata of which they are composed. My Beloch guides informed me that rain at a proper season falls on an average about every fourth year, that shortly afterwards vegetation appears abundantly, and that on those occasions the Belochees are in the habit of collecting and storing dried grass; at such seasons the botanist would doubtless find much to excite attention, but at any time the few plants found are very interesting.

A species of palm is very abundant in this division, near springs and lining the banks of water-courses. If not new, I believe it to be *Chamærops humilis*, but I have seen neither flowers nor fruit. The tree has scarcely any stem above ground; the leaves are flabelliform, and the petioles channeled with lacerate stiff margins. The denuded and dry spadix of one tree which I saw was about six feet high, with numerous lateral branchlets. The Belochees make sandals of the leaves of this tree. A *Viola* is found near water-courses, nearly allied to, if not identical with, *V. patrinii*.

A species of *Reaumuria*, with leaves differing somewhat from the described kinds, also exists on the tops of some of the lower hills. This, and a Scrophularineous plant (*Anticharis*), are the most ornamental plants found in the Lower Halas.

A *Grewia*, allied to *G. sapida*, forms small shrubs rising from the fissures of the rocks; its small red berries are eatable.

* From the Journal of the Asiatic Society of Bengal for Nov. 1847.

Orygia trianthemoides is found near the base of the hills, *Heptophyllum tuberculatum* in the upper valleys, and *Peganum Harmala* everywhere. I found *Tribulus alatus*, Del., and *Calligonum*, both Egyptian forms, at the base of the hills; a species of *Zygophyllum*, differing little from *Z. simplex*, is found forming dense matted beds near springs in the upper valleys. *Seezenia*, a Sierra Leone genus, is abundant both in the hills and at their bases; also a new species of the Cape genus *Monsonia*. *Neurada procumbens*, an Egyptian or Arabian plant, is plentiful on the borders of the Sinde desert, and also in the hills, is particularly plentiful too near Shahpoor on the western border of the desert. On the sand-hills at the same place I found species of *Rhazya*; it is a pretty small shrub with so much the habit of the garden oleander, that our sepoys called it "Bun Kunale." It is also found throughout the hills, but invariably in sandy places.

A species of *Forskalea* with ovate leaves is abundant in some places amongst the hills; the leaves of this plant adhere to everything with great tenacity, and can only be removed piecemeal; the whole plant is clothed with sharp hooked hairs.

A *Sophora*, with pretty yellow laburnum-like flowers, is also found amongst rocks near water, accompanied by *Linaria ramosissima*, and a variety of *Lindenbergia urticæfolia*. Several species of *Salsola* are also abundant; one in particular in the hilly country with terete pungent leaves and axillary capitate inflorescence, of which unfortunately I am without specimens. A new species of the African genus *Limeum* is also found on the skirts of the Halas. *Plantago amplexicaulis* is found in the inner valleys along with *Haplophyllum*. An *Echium* of the Cape type, and possibly new, and *Trichodesma Africanum*, R.B., are abundant in the fissures of rocks amidst the higher hills.

Salvia primula-Ægyptiaca, and a new species of the same section, are widely spread through the hills. A new *Linaria*, very like *L. triphylla*, is found from the base of the hills upwards.

Solanum Forskalii, or a species akin to it, is also abundant. *Hyoscyamus muticus* is found in moist places. An Asclepiad, with the habit of *Orthanthera viminea*, is very abundant on the margins of water-courses; it forms a large bushy shrub, and I suspect is the same plant described by my friend Dr. Falconer as "*Campelepis*." *Cometes Surattensis* is found occasionally along the whole base of the Hala mountains; a *Caralluma* or some nearly allied plant is abundant on the higher ranges, but I never saw it in flower; a new and pretty species of *Cleome* is found in the passes leading into the Hala range at a low elevation: with this I close my notice of the hilly region of Sinde.

The plains of Sinde are of a very variable character, some places being very fertile, and others barren, and naked desert

with little to be seen except *Salsolæ* and *Tamarisk,* and even these affect the borders of desert places.

The tamarisk on the borders of the desert in some places yields a considerable quantity of manna; it exudes from the bark of the younger branches in the form of translucent tears. It is collected in some abundance in the neighbourhood of Meher, south of Larkhana, and used to adulterate sugar; my servants eat a considerable quantity of it without being in any way affected. In fact they were wonder-stricken, and returned thanks to God for having miraculously created sugar in the desert jungle. I had about a seer of it for near a year; it remained unaltered, and was at last destroyed by exposure to rain.

This species of manna is noticed by Dr. Royle in his 'Illustrations of Botany,' p. 214. I saw neither flowers nor fruit, so cannot speak as to the species, but the shrub has the habit and appearance of *T. gallica.*

The little desert of Sinde flanks the base of the Hala range, varying from ten to twenty-five miles (or more) in breadth, extending in a southerly direction to beyond Meher, where it narrows to three or four miles, and there are more or less extensive patches of desert nearly as far south as the Munchaul Lake. In a northerly direction branches of the desert extend to near Mittun Kote, flanking the base of the Boogtee Beloch hills (spurs of the Halas) upon which Deyrah and Kahun are situated. This tract is sometimes called the Burshoree desert, from the name of a halting-place on the other side, N.W. of Shikarpoor. The soil is a hard-baked yellow clay, often exhibiting proofs of lacustrine or alluvial origin, generally extremely arid and devoid of all vegetation. In some places even in the heart of the desert *Salsolæ* are abundant, in others the surface for miles is perfectly naked; in many places saline matter abounds, efflorescing and whitening the surface, or cementing the soil, which crackles under the feet as if ice-bound; saltpetre is or has been manufactured at the southern end of the desert. It will be seen that but for the Indus this desert would form a branch of the great Jeysulmeer desert, which in some places south of Bhawulpoor approaches the Indus so closely that its sands are poured into the stream; hence we may expect the vegetation on the borders of both to be somewhat similar.

Not far south of Bhawulpoor a species of *Anabasis,* very like (if not identical with) *A. florida,* makes its appearance; this plant abounds on the borders of the desert, and on both banks of the Indus wherever the desert approaches.

The borders of the Sinde desert are usually belted with sand-hills, and outside them a belt of *Acacia catechu* of greater or less breadth.

I have already noticed *Monsonia* as existing on the western borders of the desert; I also found it in desert places in Lower Sinde.

Antichorus (*Corchorus*) *depressus* abounds on the desert borders, particularly at Khangurh; *Physalis somnifera* is also found here, and extends into the hill valleys. In Lower Sinde, south of Sewan, a species of *Euphorbia*, very like *E. pentagona*, abounds in many places forming impervious patches of jungle: near Kotree, and also between that place and Sewan, I found an "*Ochradenus*," I believe identical with the Egyptian *O. baccatus*, Delisle. *Fagonia* is abundant throughout Sinde, both in the hills and plains; I have no specimens, but considered the species to be *F. Mysorensis*; the flowers are pale purple.

At Meher and some other places a species of sugar-cane is in cultivation, which I believe to be unknown in India; it is called "Buhadooree;" the stems are slender and trailing; they grow to ten or fifteen feet in length, the base not being thicker than a finger; ten or twelve are usually fastened together so as to afford mutual support; the cane is said to yield the best sugar, but in small quantity. *Cleome ruta*, Jacqt., is abundant on the rocks at Sukkur and throughout Sinde. *Typha angustifolia* is found on most lands subject to the annual flooding of the Indus, and from it vast quantities of mats are manufactured. A species of *Adenanthera*, I believe *A. pavonia*, is often found near villages in Lower Sinde; this tree has a weeping habit, and at a distance looks not unlike *Salix Babylonica*. A remarkable species of *Acacia* is also found near villages; in its mode of growth and appearance it strongly resembles the funereal cypress. The Sindeans call it "Cauboolee Baubool," a name which points to its foreign origin.

I was not fortunate enough to see this tree either in blossom or fruit. Between Kotree and Kurrachee I noticed a species of wild cotton trailing up trees to twenty feet; I was sick in a doolee at the time and unable to take specimens.

Dodonæa Burmanniana, and I believe another species, are found in Lower Sinde. *Aristolochia bracteata*, and a *Verbena* akin to *V. officinalis*, but perhaps distinct, exist on the smaller hills of Lower Sinde; *Orthanthera viminea* abounds throughout Sinde and is a very useful plant; like many others of its order, the bark yields a strong fibre; in this shrub it is of greater length than perhaps in any other Asclepiad. I am not aware of the fibre being used by the Sindeans, but the thin osier-like branches are bruised, and twisted into a strong coarse kind of rope in common use.

There are also numerous well-known Indian forms of plants in the plains of Sinde, particularly near the cultivated districts, of which I took neither notes nor specimens; the date flourishes

in several parts of Sinde, but thrives best at Sukkur and its vicinity, on both banks of the Indus. There are two varieties: one with pale yellow, and the other with brown fruit; the fruit is smaller than the Egyptian date, but when ripe is very palatable; only certain trees produce good fruit, about a third of the whole perhaps. The fruit of the remainder is injured by tapping for the juice, from which sugar is manufactured.

The plants of the coast are of a mixed and peculiar character, and many of them belong to more northern genera. *Serræa incana,* Cav., grows plentifully on the sand-hills of the coast; the only known species of this genus is a native of Succotra, and is described as being only three inches high. The Kurrachee plant forms a bush two feet in height, and when in flower is very pretty; perhaps it may be a new species.

A very hoary *Atriplex,* not far removed from *A. verruciferum,* is also very plentiful: *Ipomæa bilobata* spreads over the sand in every direction, and *Scævola Taccada,* Roxb., is abundant on the tops of the sand-hills; the berry is white at first, but turns purple when ripe. A new species of *Ægialitis* is also found all along the coast, and a new shrubby plant of the *Paronychiæ,* with the bark and almost the leaves of an *Equisetum.*

Cadaba Indica? grows on the rocks at Minora Point; I also noticed this plant in the Hala mountains, but am rather doubtful as to the species; I have only seen the cucumber-shaped fruit which is made into a pickle by the Sindeans.

I shall now proceed to notice *seriatim* such plants of my herbarium as appear to me deserving of elucidation.

Umbelliferæ.

Indigenous plants of this class are rare in Sinde; I have but one specimen from the Hala mountains, which for the present I have referred to—

1. "*Libanotis*;" the plant smells strong of asafœtida.

Rhizophoraceæ.

I found a fresh flowering branch of a tree of this class floating in the surf on the beach at Kurrachee, but nowhere detected living trees.

2. It belongs to the genus "*Ceriops*" of Arnott; the many mouths of the Indus will doubtless afford others of this order.

Cruciferæ.

3. A species of *Farsetia* abounds from Bhawulpoor throughout Sinde; it is often the only food procurable for camels, who eat it greedily along with a frutescent *Crambe*? In the Hala mountains it is used for the same purposes.

Capparideæ.

4. *Cleome ruta,* Jacqt.: Sukkur and other rocky places in Sinde. The petals are pink, and bear at the base of each a fringed scale.

5. *Cleome fimbriata,* Vic.: lower hills in Sinde.

Stems and leaves hispid from gland-capitate stiff hairs; leaves all simple, lower ones long-petioled, round-cordate, quintuple-nerved, outer lateral nerves lost in the margin, three medial nerves stronger and inarcuately reaching the apex. Upper leaves smaller, subconform narrower, subsessile; flowers pale purple? from the terminal axillæ; pedicels lengthening in fruit; calyx clothed with gland-capitate hairs. Sepals four, subequal, lanceolate. Petals four, shortly clawed with acute oblong-deltoid laminæ, apices bearing out gland-capitate hairs, and ciliate with them; bases toothed slightly on the margins, and bearing above claw transverse free fimbriate petaloid scales. Fertile stamens four, rather longer than petals, one anther larger, torus small. Ovary subsessile, linear, rather rough; style caducous, cylindric, short; stigma discoid, capitate. Capsule linear-cylindric, furrowed on opposite sides, shortly stipitate, densely clothed with strongly stipitate, peltate glands, one-celled, two-valved, valves separating from the placentiferous narrow replum; seeds numerous, cordiform, smooth, amphitropous. I have given my note of this plant, as it seems to be not far removed from *C. Droserifolia,* Del.; and perhaps eventually it may prove to be the same.

6. *Cleome rupicola,* Vic.: passes leading into the Hala range of mountains and lower hills.

This plant is not unlike *C. glauca,* DeC., vol. i. p. 239, but the stems and leaves of my plant are clothed with scattered gland-headed hairs, and the young branches are four-angled. Leaves elliptic, ovate and obovate, petiolate, upper leaves reduced to linear-lanceolate bracts. Racemes often six inches long. Petals orange-rufescent, secund, smooth; stamens secund, in an opposite direction to petals, six; gland of the torus semilunate; siliques pendulous, falcate, flat, subsessile, fifteen lines long, two lines broad, bearing some scattered capitate hairs; seeds densely beset with brown hairs, numerous.

7. *Cadaba Indica*?: on rocks near Kurrachee and Hala mountains.

I am doubtful about this plant, having seen it only in fruit. The leaves near the apices of branches are often supported by two stipulary thorns. The fruit is nutant, longly stipitate and cucumber-shaped, bluntly trigonal, three to four inches long, and turning red when ripe.

Resedaceæ.

8. *Ochradenus baccatus,* Delile : Lower Sinde. I believe this to be the Egyptian plant, although the Sinde one differs in some trifling particulars ; my specimens are not sufficiently advanced to show the spinifacient habit.

Violaceæ.

9. *Viola patrinii,* D.C. : Kurrachee and Hala mountains.

Reaumuriaceæ.

10. *Reaumuria Hypericoides,* Wild.: Doz Akhooshtee, and spurs of the Hala mountains.

The leaves of the Sinde plant are spatulate-linear and crowded to the ends of the branches.

Sapindaceæ.

11. *Dodonæa Burmanniana,* D.C. : Lower Sinde. This shrub is not more than three feet in height, with leaves about an inch in length, never more, and blunt cuneate-linear. I have some doubt as to the species ; there is another in Sinde of which I have no specimens.

Malvaceæ.

12. *Althæa pumila,* Vic. : near Shikarpoor. Plant herbaceous, from six to ten inches.

Stems slender, stellately hairy, stipules ovate, leaves stellate, hairy on both sides, lower ones caudate at base, palmately three-partite with the lateral lobes bifid, the apices roundly tridentate, mid-lobe cuneate, the apex roundly three- five-toothed. Flowers very shortly pedicelled, axillary, blue. Involucre ten-cleft with linear lobes. Calyx half five-cleft, with acute lobes ; anthers about ten ; styles ten, filiform. Stigmas capitate. Carpels arranged round a central shortly ten-winged columella, the apex of which is filiform, not marginate, transversely corrugate, one-seeded.

13. *Pavonia odorata,* Wild. : between Kurrachee and Hyderabad.

14. *Serræa incana,* Cav. : sand-hills, Kurrachee. This plant is rather pretty when in flower ; it forms small bushes about two feet in height. Anthers twenty-five to thirty, stipitate, reniform, one-celled, stigmas ciliate.

15. *Abutilon Indicum* : Sinde and Hala mountains.

16. *Sida acuta* : plains of Sinde.

Tiliaceæ.

17. *Antichorus* (*Corchorus*) *depressus,* Linn. : Khangurh and borders of desert.

18. *Grewia sapida* ? : all hilly places in Sinde. I have doubt-

fully referred this to *G. sapida,* but I suspect it is a very different plant; my specimens are not sufficient to determine; the petals bear a large scale at base and are bifid with toothed lobes. The berry is red and eatable when ripe.

PORTULACEÆ.

19. *Orygia decumbens,* Forsk.: eastern base of Hala mountains. The sepals and petals are red, and the stems and leaves are often coloured; this plant does not seem to differ much from *O. trianthemoides,* Heyne.

PARONYCHIEÆ.

20. *Cometes Surattensis*: all Sinde.

RUTACEÆ.

21. *Peganum Harmala*: all Sinde.
22. *Haplophyllum tuberculatum,* Andr. Juss.: near Deyrah, Boogtee Beloch hills.

ZYGOPHYLLEÆ.

23. *Tribulus alatus,* Del.: eastern base of Hala mountains.
24. *Fagonia Mysorensis*: Sukkur and all Sinde.
25. *Zygophyllum obtusum,* Vic.: valleys of the eastern slopes of Hala range; plants gregarious, herbaceous, decumbent, pale green. Leaves fleshy, simple, spatulate-linear, blunt, or rounded at apex, sessile and subsessile, stipules acuminate, scales at base of stamens deeply bifid. Capsule deeply five-wing-lobed, five-celled, each cell opening inwards, with two to three pendent seeds. Flowers shortly pedicelled, yellow.
26. *Seezenia lanatum,* Wild.: all rocky places in Sinde. The stamens in the Sinde plant are most certainly alternate with the sepals of calyx, and not opposite to them; some doubt may exist with respect to the identity of this plant with that from Sierra Leone, I therefore give my note of it.

Plant spreading, semi-erect, stems and branches flexuose, woolly at the joints within the stipules; younger branches, under surface of leaves, and their margins papillose from sessile glands, otherwise smooth; leaves petioled, opposite, three-foliate, midleaflet obovate, often retuse, lateral leaflets oblique-ovate, all entire and shortly apiculate, stipules linear, often uniting with the margins of the stipules of the opposite leaf and thus appearing interpetiolary; flowers green tinged with yellow, axillary, solitary, pedicels in fruit longer than the leaves. Calyx five-parted with a valvate æstivation, lobes lanceolate, each bearing opposite the centre of its base an adherent scale half its length and with free shortly fimbriate margins; stamens five, hypogynous, opposite to the divisions of calyx; filaments slightly flattened, smooth, tapering; style five-

cleft almost to the base, with long linear terete lobes; stigmas capitate, rough; ovary oblong, five-celled and ribbed. Ovules five, pendent from the apex of columella. Capsule five-furrowed and seeded, detaching from base into five cocci, and thus remaining for a long time pendent by short funiculi from the seeds to the apex of columella; the cocci are internally bivalved and perforated on the inner angles of apices for the passage of the funiculi. Columella persistent for a long time after the seeds have fallen, five-angled, with the apex discoid, five-lobed, and with the placentas in the sinuses between the lobes; seeds brown, oblong, acute at both ends, with a scanty green arillus.

Geraniaceæ.

27. *Monsonia Asiatica,* Vic.: eastern base of Hala mountains and Lower Sinde.

I believe that this is the first species of *Monsonia* found out of Africa. The Sinde plant belongs to the section "Holopetalum." Plant semi-erect, herbaceous, clothed everywhere with long, white, silky hairs; leaves long-petioled, cordate-ovate, blunt, irregularly dentate, seven-nerved, stipules herbaceous, linear-lanceolate; peduncles slender, two- to five-flowered, with from four to six unequal linear bracts at apex, pedicels slender, flowers blue. Calyx sepals apiculate, three-nerved, petals entire, stamens pentadelphous in a double series. Capsule very longly rostrate.

Rosaceæ—Sub-ord. Neuradeæ.

28. *Neurada procumbens,* Linn.: borders of Sinde desert, at base of Hala mountains, and near Shahpoor. This curious plant has heretofore been noted as a native of Egypt, Numidia and Arabia.

Leguminosæ.

29. *Sophora tomentosa,* Linn.? At Coombe in the Boogtee Beloch hills, a shrub of four feet.

30. *Crotolaria arida,* Royle: borders of desert.

31. *Crotolaria oxalidifolia,* Vic.: eastern base of Hala range. Prostrate or semi-erect, with branches from six to eight inches long, all parts clothed with appressed strigose hairs, stipules lanceo-linear, adnate; leaves petioled, three-foliate, leaflets shortly petiolulate, midleaflet obcordate, lateral leaflets oblique, obovate, blunt; peduncles slender, opposed to a leaf; legume sessile linear, trigonous, hairy, nine-seeded and constricted between the seeds.

32. *Tavernieria nummularia,* D.C.: Hala mountains, near Deyrah.

33. *Alhagi maurorum,* Tourn.: Sinde passim.

34. *Cassia obovata,* Collad.: Sinde passim; this plant is also abundant in the Punjaub.

35. *Adenanthera pavoniana*? Near villages, cultivated? Plants of this order are comparatively rare in Sinde; my herbarium contains only four others, and two of these are *Indigoferæ.*

URTICACEÆ.

36. *Forskalea ovata,* Vic.: Hala mountains. Plant rising erect to two feet, all parts clothed with sharp hooked hairs; leaves alternate, triple-nerved, white, tomentose beneath excepting the nerves, lower ones broad ovate, upper ones ovate, all narrowed at base into the petioles and grossly dentate; involucres of four to seven linear-spatulate lobes. This plant comes near *F. tenacissima,* and perhaps may be a broad-leaved variety of it.

ARISTOLOCHIACEÆ.

37. *Aristolochia bracteata*: Lower Sinde.

CHENOPODIACEÆ.

38. *Salsola Indica*: Sinde desert and Halas.

39. *Salsola stricta*?: Upper and Lower Sinde.

40. *Anabasis florida,* M. B.: borders of Sinde desert, and banks of Indus to near Bhawulpoor.

41. *Atriplex verruciferum,* M. B.?: sand-hills near Kurrachee. I have doubtfully referred this as above, but it is probably a new species. The whole plant is lepidate-hoary and shrubby. Leaves shortly petioled, oblong, ovate, and obovate, blunt, narrowed at base into the petioles, lower leaves often remotely toothed. Upper leaves entire, valves of fruit orbicular with the reflexed entire margins and subcordate bases lepidate, otherwise smooth. Stamens of the male flowers five.

PHYTOLACCACEÆ.

42. *Limeum obovatum,* Vic.: skirts of the Hala mountains near Kotree. Roots ligneous, descending deep into the soil; stems herbaceous prostrate, minutely pubescent. Leaves cuneate obovate and ovate, obtuse with a point, minutely pubescent; flowers opposed to a leaf, three to five together, very shortly pedunculate, pedicels minutely bibracteolate. This plant comes near *L. Capense.*

POLYGONACEÆ.

43. *Calligonum Polygonoides*?: all Sinde. The specific characters of this curious genus are founded on peculiarities of the fruit; unfortunately I have never seen the fruit of our Sinde shrub, and have merely referred it to *C. Polygonoides,* because that plant makes a nearer approach in habitat to Sinde than *C. Pallasia.* This shrub is common throughout Sinde, and is found on the banks of the Indus nearly as far up as Bhawulpoor; near Shahpoor, at the eastern base of the Hala mountains, it is most

abundant, forming small trees of ten or twelve feet high, with a diameter of six to ten inches at base; when in full flower it looks rather pretty.

Menispermaceæ.

44. *Cocculus leeeba* ?, D.C.: Lower Sinde.

Myrsinaceæ.

45. *Ægiceras fragrans,* Kon.: mud-flats, Kurrachee harbour.

Convolvulaceæ.

46. *Ipomæa bilobata*: sand-hills, Kurrachee.
47. *Convolvulus lanuginosus,* Desr.: Hala mountains.
48. *Convolvulus parviflorus,* Vahl: base of mountains.
49. *Breweria evolvuloides* ?, Chois.: Hala mountains. As I feel considerable uncertainty about this plant, I add my note.

Shrub erect, of one to two feet, stems slender, ligneous, all parts densely clothed with a sericeous pubescence. Leaves very shortly petioled, elliptic, upper ones lanceolate, entire, mucronate and emarginate from the reflexed mucro, triple-nerved, pubescence more dense beneath. Flowers axillary, one to three together, subsessile. Calyx persistent, not enlarging, with two linear bracts at base; sepals, three exterior and two interior, a little shorter, lanceolate acute, hairy beneath. Corolla with a deeply five-lobed limb, the lobes hairy beneath. Stamens scarcely exsert, filaments broad at base with five short teeth alternating, anthers reniform-cordate, ovary two-celled, ovules four, styles two, divergent, filiform, stigmas discoid orbicular, continuous (not peltate). Capsule chartaceous, dry, hairy towards apex, longer than the dry calyx, two-celled, septa membranous, four-valved; seeds from two to three, oblong, black, very minutely scrobiculate, of a nutty hardness.

50. *Evolvulus linifolius*: base of Halas.
51. *Cressa Cretica,* var. *Indica*: all Sinde.

Scævolaceæ.

52. *Scævola Taccada,* Roxb.: tops of sand-hills near Kurrachee.

Plantagineæ.

53. *Plantago amplexicaülis,* Cav.: Hala mountains.

Plumbagineæ.

54. *Ægialitis obovata,* Vic.: sand-hills, Kurrachee. Shrub of two feet, stems ligneous, annulate with the ensheathing bases of fallen leaves, densely foliaceous upwards; leaves blunt cuneate-obovate, retuse, glaucous hoary, smooth, articulated to the sheaths at base, spikes paniculate, flexuose, terminal flowers secund, utriculus bursting at the apex into five short acute teeth.

Boragineæ.

55. *Heliotropium Rotleri*: Kurrachee.

56. *Echium* ?: Hala range. I am unable to refer this to any of the many described species, and therefore attach my note.

Plant fruticose, erect, about a foot in height, growing from fissures in rocks. Younger stems, leaves and calyces densely clothed with short appressed strigæ. Leaves five to six lines long, ligulate-linear, blunt-pointed, sessile, alternate. Racemes simple, many-flowered; flowers solitary, sessile, secund, bluish white, bracts like the leaves but smaller, bracteoles none, pedicels short, adherent to rachis for half their length. Calyx with blunt linear unequal segments (sometimes only four, the fourth broader); tube of the corolla ten-nerved with a ring of hairs within at base, smooth in the middle, and the faux closed with hairs which indistinctly form five very small tubes between the anthers; lobes of limb patent, blunt-ovate, slightly auricled at base (one lobe often broader). Margins minutely and remotely toothed. Stamens not exsert, filaments very short, anthers mutic, linear-oblong blunt and undivided at base, style shortly exsert, its base becoming angular in seed; stigma peltate capitate with two minute central points; achenia rather smooth with an incurved point, one or two, often only one maturing, attached to base of style, perforation at base oblong triangular.

57. *Trichodesma Indica*: Sinde passim.

58. *Trichodesma Africanum*, R. B. ?: Hala mountains.

I have referred this to the above with some doubt; it has the same prickly hispid habit, but differs in some particulars; plant growing from fissures in rocks, erect, 1 to 1½ feet. Leaves and stems dark green, hispid from hard white prickle-bearing calli, leaves opposite at the divisions of the racemes, otherwise alternate, upper leaves subsessile, lanceolate, acute, prickles longer on the margins and midrib beneath. Racemes lax, the lower ones from opposite axils, upper from alternate axils and terminal; peduncles usually three-flowered, lengthening with the enlarging calyx in seed; bracteoles none; calyx rigid, hairy, five-angled with rounded auricles, segments acute, corolla blue with caudate lobes, stigma simple, blunt, pedicels lengthened with the much-increased and nutant calyx in seed, achenia four, subtrigonal, the outer faces concave, marginate, the margin acutely serrulate with slightly glochidiate teeth.

My specimens do not exhibit the lower leaves.

Labiatæ.

59. *Salvia Ægyptiaca*, Linn.: slopes of Hala mountains.

60. *Salvia pumila*, Benth: slopes of Hala mountains.

61. *Salvia Halaënsis,* Vic.: slopes of Hala mountains. Plant of ten to twelve inches, erect; old stems ligneous, younger stems obsoletely four-angled, densely clothed with short hairs and sessile yellow glands; leaves much-corrugated, cordáte-ovate and broad-ovate, blunt or rounded; slightly winging the short petioles, and often forming two lateral denticulæ at their apices; margins undulate lobate-crenate. Racemes two to three inches long, dense-flowered, subspicate; flowers blue, solitary, almost sessile; floral leaves small, bractea-formed, ovate, entire, hairy and longly ciliate; bracteoles nearly as long as bracts, linear-lanceolate, hairy; calyx lanato-pilose, enlarging and becoming nutant with the lengthening pedicel; upper lip shortly tridentate; the mid-tooth smaller, all acute, lower lip bipartite with linear filiform lobes. Corolla, upper lip erect, short, bifid; mid-lobe of lower lip orbicular emarginate.

The achenia of this plant give out much mucilage in water.

Verbenaceæ.

62. *Verbena officinalis*?: spurs of the Hala mountains, Lower Sinde. I have referred this doubtfully to *V. officinalis.* The foliage of my specimens is from the ends of the flowering branches. The leaves are petioled, opposite and alternate, both surfaces shortly pilose, ovate and broad-ovate, blunt or emarginate, five-nerved, margin serrate, with the three serratures at the apex larger.

Scrophularinæ.

63. *Linaria sindensis,* Vic.: base of Hala mountains, Upper and Lower Sinde. This plant is extremely like *L. triphylla.* Herbaceous, stems procumbent or semi-erect, eight to ten inches; leaves scattered, solitary, glaucous, entire, ovate, narrowed into and winging the petioles; apices soft-pointed; young leaves often shortly pubescent; flowers purple tinged with yellow, subsessile, axillary, solitary, bracteoles none; upper lobe of calyx foliaceous, broad-ovate, greatly exceeding the other four linear-lanceolate lobes; lower stamens with their anthers united; stigma simple; capsule obliquely globular, two-celled, upper cell abortive, lower cell many-seeded, bursting irregularly; seeds conical. Testa spongy, furrowed.

Linaria ramosissima, Wall.: Hala mountains. The Sinde plant is softly pilose, in other respects it is the same.

Anticharis, Endlich.: Hala mountains.

A. viscosa, Vic. This plant belongs most certainly to Endlicher's genus, and probably to the very species, but as I have no means of referring to the specific characters given, I have allowed my herbarium name to stand for the present.

The Sinde plant is so viscous that everything adheres to it. Flowers blue; leaves ovate-lanceolate, narrowed into the short petioles: pedicels short, minutely bibracteolate above the middle: seeds truncate, oblong, longitudinally grooved with minute transverse striæ.

SOLANACEÆ.

Solanum Forskalii, Dun.; *cordatum*, Fors.: Hala mountains. Both species appear to be different forms of the same plant; our Sinde plant is sometimes prickly, sometimes not; the leaves are variable also. Stems slender; prickles both curved and straight, near the ends of the branches only; young shoots and leaves starry pubescent, old leaves smooth, round-cordate or subcordate at base, narrowed into the petioles, margin entire or occasionally sinuate toothed; flowers rather longly pedicelled, blue; the corolla greatly exceeding the half five-cleft calyx; berry red, smooth, rather larger than a pea.

Physalis somnifera, var. *flexuosa*: all Sinde and Hala mountains.

Hyoscyamus muticus, Linn. Hala mountains.

APOCYNEÆ.

Rhazya stricta, Decaisne. This shrub is abundant in the Hala mountains and at their eastern bases, but particularly at Shahpoor. It usually grows upon sand-hills, and has somewhat the habit of our garden oleander, but does not rise to more than three feet. The flowers are pale blue turning white by age. There is a small entire margined nectarium.

ASCLEPIADEÆ.

Periploca aphylla, Dec. Bot. Jacq. All hilly parts of Sinde.

This is my friend Dr. Falconer's *Campelepis*, Ann. Nat. Hist. vol. x. p. 362. This shrub abounds in the Boogtee Beloch hills near Deyrah.

The habit is that of *Orthanthera viminea*; the branches are devoid of all pubescence. The leaves are linear-lanceolate (not ovate), and are seen only on the young surculi. The flowers are of a dark dull red colour; the long uncinate filiform processes of the faucial corona are inflected over the genitalia in the earlier stages of the flower, but subsequently become reflexed through the divisions of the corolla. The pollen of this plant requires to be reexamined in the fresh flowers; in my opinion it not only differs from that of *Periploca*, but from the pollen of every genus of the order.

Orthanthera viminea. All Sinde.

With few exceptions the above-noted plants are foreign to our

Indian flora, flourishing between the parallels 25° and 30° N. lat., or nearly equivalent to the tract between Allahabad and Hurdwar. At first sight it appears strange that so many northern forms should exist in Sinde in excess of those found between the same parallels in India, but a slight examination of the countries forming our northern frontier will, I think, sufficiently account for it. The Himalaya mountains, the Hindoo Coosh, and probably the Tukt-i-Sulleemaun range, form an impassable barrier to certain classes of plants, but the lower ranges of the Hala mountains, which in many places are not more than 1500 feet above the sea, offer no such obstacle; besides this there is the coast-line, which with its constantly drifting sands offers a facile mode of transmission to seeds; thus we find several Egyptian, Arabian, Persian and African plants in Sinde: that they have not spread into India seems also easily accounted for; the Indian desert of Jesulmeer proves in a south-eastern direction a sufficient preventative. The course *viâ* the banks of the Indus is to a narrow extent only open to the north-east, and accordingly we find some Egyptian forms extending to Delhi and its neighbourhood, as has been remarked by my friend Dr. Royle in his 'Illustrations of Indian Botany,' pp. 70 and 160.

Salvadora persica, Capparis aphylla and *Farsetia,* are found throughout Sinde; however *Giseckia,* so abundant near Ferozepoor, is not found in Lower Sinde; *Orobanche Calotropidis,* Edgw., is found from Umballa to Kurrachee, and is extremely abundant in Lower Sinde; the flowers of this plant are changeable, being blue at first and becoming pale yellow, hence two varieties have been supposed to exist. No Scitamineous or Orchideous plant exists in Sinde; of the latter order *Zeuxine* is sparingly found under the tamarisks, nearly as far as Subzulkote, following the course of the river.

The coast-line alluded to above offers no obstacle to the diffusion of plants in a southerly direction *viâ* Cutch and Goozerat towards Bombay, but as yet these countries, the delta of the Indus and the south-western tail of the desert are botanically unknown; in the other direction, a botanical excursion to Sonmeeanee Bay, or farther if possible, would serve to connect our Indian flora with that of Africa, Persia and Arabia.

I have still some curious Sinde plants of which I hope to give an account hereafter.

Subathoo, 27th September, 1847.

XLV.—*Reply to* Mr. Smith's *Remarks on* Dr. Mantell's *Account of the* Ventriculites.

To the Editors of the Annals of Natural History.

Gentlemen,

It is with great reluctance that I intrude on your indulgence and request permission to notice some of Mr. Smith's animadversions on my figures and descriptions of the chalk zoophytes which I first distinguished by the name "*Ventriculites,*" in a memoir published in the 'Linnæan Transactions' in 1815; although I ought perhaps to consider myself as *hors de combat,* since Mr. Smith concludes his memoir by the assertion, "*that the field was entirely untrodden, and the task a new one*;" the nature of those zoophytes "*being totally unknown*" till he undertook to elucidate the subject!!

I should not presume to occupy your pages by a lengthened comment on Mr. Smith's communications, even could I fully comprehend the author's meaning, which in many instances I am unable to do, for his genius has removed a subject, which I once imagined to be simple and easily interpreted, far above my feeble capacity. But I feel that it would be uncourteous to the readers of my works, who indulgently give me credit for truthfulness and accuracy of observation, were I to pass wholly unnoticed Mr. Smith's impeachment of my scientific veracity. I shall therefore content myself with affirming, that notwithstanding all the remarks Mr. Smith has inscribed on your pages, I see no reason whatever to alter a single word in the following description of the zoophytes which I designated *Ventriculites,* extracted from my 'Medals of Creation:'—

"The original form of the Ventriculite was that of a funnel, or hollow inverted cone, terminating in a point at the base, whence numerous fibres proceed, and by which the zoophyte was attached to other bodies. The outer integument was reticulated—that is, disposed in meshes like network—and the inner surface was studded over with regular openings, the orifices of tubular cells, each of which was *probably* occupied by a polype. The substance of the polyparium or framework of this aggregation of animalcules appears to have been analogous to that of the soft Alcyonia, and to have possessed a common irritability, and been able to contract and expand. This opinion is based on the circumstance that some specimens occur in which the zoophyte is in the form of a nearly flat circular disc, and in others, in that of a subcylindrical pouch: *in the former state, the outer reticulated structure is elongated, while in the latter it is contracted and corrugated.* The polype-cells are cylindrical and very regular: the flints often present beautiful casts of them, which appear like rows of minute pillars on the inner surface."

Mr. Smith's "*folded membrane,*" "*polype-skin,*" &c. are in my opinion purely imaginary. If the tubular cavities disposed with so much regularity on the inner surface of the fossils to which I restricted the term Ventriculites were not cells inhabited by polypes, then I affirm that we have, at present, no evidence that any of these zoophytes were polypiferous; and I readily admit that this may still be regarded as an open question. The only unequivocal instance I have seen of the soft parts of a polype from the chalk strata, is one in flint discovered by the Rev. J. B. Reade, and figured in the 6th edit. of my 'Wonders of Geology,' p. 304: but there is no proof that this polype belonged to a Ventriculite.

How far it may be deemed expedient to admit of the application of the term "*cephalic membrane*" to the margin of a cup-shaped zoophyte, or to group together under the name of *Ventriculidæ* the incongruous assemblage of fossil zoophytes thus classed by Mr. Smith, I leave for competent naturalists to determine.

To those geologists who like me aspire only to a general knowledge of the organic remains found in the respective strata, I believe that the accurate and simple exposition of the form and structure of the *Ventriculites*, given in my works, long before Mr. Smith commenced his arduous labours, will be found alike true to nature and perfectly intelligible: the sublime transcendentalisms in the communications to which the above remarks refer, are far beyond the comprehension of such humble observers as, Gentlemen, your very faithful servant,

GIDEON ALGERNON MANTELL.

Chester Square, Pimlico, May 5, 1848.

XLVI.—*Reports on the Progress of Physiological Botany.* No. 4. By ARTHUR HENFREY, F.L.S. &c.

On the Multiplication of Vegetable Cells by Division.

ON the 22nd of November 1847, Prof. Mitscherlich read before the Royal Academy of Berlin, a portion of an essay on the Development and Composition of the Confervæ. This has been published in the monthly report of the Academy*, and is so instructive that it deserves a somewhat detailed report here.

Prof. Mitscherlich selected the Confervæ on account of the simplicity of their structure and the rapidity of their development, and *C. glomerata* is the species which he found best adapted for the observations, as the cells are very distinct from each other, and develope well beneath the microscope. Moreover

* Monatsbericht der Königl. Preuss. Acad. Nov. 1847.

it is the plant on which Mohl's observations on cell-division * were made, which observations however were made on distinct individuals in different stages of development.

The author placed the plant on a slip of glass, covered it with thin glass, and laid a loose filament of cotton round the latter, the end of the filament being made to dip in a glass of water close to the stage, so that as often as the evolution of gas from the plant elevated the thin glass, the water soaked up by the filament ran in and kept the plant constantly surrounded with water. By this means he was enabled to continue the observations on one plant for several weeks.

In the first place Prof. Mitscherlich gives an account of the structure of the plant and the action of various reagents upon the tissues. The entire plant, with all its branches, is surrounded by a common, connected membrane; this may often be clearly distinguished in perfect cells from the membrane of the individual cells; it withstands the action of acids longer, although much thinner, so that when sulphuric acid is applied to the Conferva under the microscope, the membrane of the cells is dissolved, and when after some time openings occur in the outer enveloping membrane, the contents escape, and the envelope remains as a tube with very thin walls. It is clear that the envelope is yet undecomposed, and that what is seen is not the mere remnant of an enveloping membrane, from the fact, that when the upper part of the tube is properly focused, it requires a quarter of a revolution of the adjusting screw to bring the lower part into focus. The envelope is finally dissolved by the sulphuric acid, without acquiring a brown colour or leaving a brown residuum; therefore it is distinct from the substance of the long cells of wood, or of the cells of the stones of fruits; it is not coloured blue by iodine and sulphuric acid, therefore it is not cellulose; it was not possible to obtain enough of it for analysis; it agrees best in its peculiarities with the cell-membrane of Yeast. No special structure could be made evident by any mechanical or chemical means.

The cell-membrane which forms the wall of every individual cell consists of vegetable fibre-substance (*Faserstoff*), the so-called cellulose. It is coloured brown by iodine, and when sulphuric acid is applied to the wall thus coloured, every part acquires an intense blue tint and then it dissolves, the blue colour disappearing without leaving a trace of brown behind †. From all researches at present known to us, the blue colour which iodine pro-

* Vermisch. Schrift. p. 363, 1845.

† The author recommends a saturated solution of iodine in iodide of potassium or sodium, to avoid the inconveniences attending the separation of the iodine which occurs when the alcoholic tincture is used.

duces can only indicate a compound of iodine with starch. Iodine in a divided condition, whether dissolved or in powder, is always brown; but that the blue compound which fibre-substance (cellulose), iodine and sulphuric acid produce, when washed away with water leaves a residuum which gives no blue colour unless sulphuric acid is again applied, implies that the starch which has been found has been converted into dextrine by the addition of water and the presence of concentrated sulphuric acid.

When the Conferva is heated with hydrochloric acid of the usual strength, the cell-wall swells up and splits into separate fibres, the diameter of these being less than $\frac{5}{10000}$ths of a millimetre. They often appear as long as the cell, and lie side by side in the direction of the length of the cell; no spiral arrangement or crossing of these fibres could be observed. The walls of many cells, which consist of cellulose, become split up into such fibres by boiling in hydrochloric acid; this may be seen very plainly in the bass-fibres of flax, and a splitting-up of this kind occurs in mechanical operations upon them, as in the manufacture of paper. The cuticle does not pass in between the contiguous cells, so that the walls of the two cells are in immediate contact.

The contents of the cell consist at first of a gelatinous mass, coloured green by chlorophylle; the green colouring matter, which forms but an insignificant proportion of the whole, is dissolved on the addition of hydrochloric acid, and the gelatinous mass contracts. Iodine colours the mass brown, and then denser masses (nuclei), which lie irregularly scattered through it, become more evident. It withstands the action of sulphuric acid longer than the cellulose; heated with nitric acid and then saturated with ammonia, it gives the xanthoproteate of ammonia, and therefore consists at least in part of proteine compounds.

At a certain epoch of the development the nuclei of the gelatinous mass become opake and increase in diameter; then starch can be distinctly detected in their interior by means of iodine; in other Confervæ, for instance in *Spirogyra*, these points, in which starch is sometimes formed, may be perceived more distinctly. Sometimes the green gelatinous mass lies closely applied to the cell-wall in *C. glomerata*, and the whole cell is densely filled with it; sometimes, and particularly in rapidly developing cells, a clear fluid lies between the gelatinous mass and the wall, and in this fluid sometimes occur particles in molecular motion; spaces filled with clear fluid also occur in the interior of the mass, and are traversed by reticulated processes of the gelatinous matter.

The author observed and determined the growth and multiplication of *C. glomerata* in cooperation with his assistant M. Lasch,

in a great number of specimens; it will be sufficient to describe the complete course of the changes.

On the 19th of September a lateral branch consisted of two cells; on the 21st of three; on the 23rd of four; on the 24th of six; on the 26th of seven cells; in another branch from a cell at some distance, the same multiplication and enlargement occurred. No formation of cells within cells was observed, solely multiplication by division. This usually commenced when the length of the cell was about $\frac{4}{10}$ths of a millimetre.

The gelatinous mass usually separates a little from the cell-wall, and then a small ring is formed upon the latter; thus in the fourth cell of a side branch nothing was perceptible in the morning, then the foundation of a ring was formed; some two hours later the diameter of the ring was already more than half the diameter of the internal cavity of the cell; the gelatinous mass was retracted. About a quarter to one o'clock the mass parted so as to leave a cavity; a few moments after the mass divided on one side, and about half-past two the division was complete. The formation of a septum is generally effected in from four to five hours; the wall is a new structure and by no means a constriction *; it is at first a very thin membrane which extends across from one wall to the other; fresh cellulose is deposited upon this membrane, and when the cell elongates and enlarges every cell exhibits its own proper wall, which, where the walls of the parent-cell and new cell are in contact, stands apart from the former. Sometimes it happens that a cell-wall is only half-developed, very often only on one side; deposits are then subsequently found on these structures; and unless the development of the membrane is continuously traced under the microscope, these structures may easily be taken for the commencement of infolding or constriction.

If the Conferva is boiled in solution of soda of 1·35 sp. gr., which does not dissolve but loosens the texture of cellulose, the deposited mass frequently separates from the septum by which the division is first of all produced, and thus it may be distinctly observed; acetic acid has the same effect. The division takes place most frequently in the terminal cell, but also very often in the others, even in the old cells of the primary filament.

From the manner in which the gelatinous mass is divided by the new membrane, it is very clearly seen that the mass is not surrounded by a membrane; projecting pieces also and separate portions of the gelatinous mass are generally seen, which are not

* The author appears to misunderstand the way in which the constriction is said to take place. No one now supposes that the cell-wall is constricted, only the contents; and the septum is certainly a new structure, a double layer of membrane formed in the fold.—A. H.

inclosed in a membrane. When solutions which act through endosmose are applied to the cells, these abstract water from the gelatinous mass, and the outermost layer, which thus becomes the densest, may easily be mistaken for a membrane. The side branches are formed by the bulging-out of a cell, and this always occurs at the same end in all cells; thus if we call the end of a cell where such a protrusion has occurred, the upper end, it will be found at the upper end of all the cells. This bulging portion elongates into a cell, and the membrane which produces the division is usually formed close to the parent-cell. Sometimes it happens that if the parent-cell dies, or the contents have run out by a wound, the cell of the lateral branch elongates into the parent-cell.

The formation of the lateral branches by protrusion is of especial interest for the explanation of the multiplication of the top-Yeast (*ober-hefe*); no formation of cells within cells takes place in this. The author has repeatedly observed the whole course of the formation of a cell, in Yeast, beneath the microscope, and no little cell could ever be seen in the little nodule which first of all originates by the bulging-out of the parent-cell; a small granule of the contents of the parent-cell sometimes lay in front of the place where the bulging took place, but this never entered the young cell. In the bulging of the *C. glomerata* an opening exists which is almost as wide as the new cell; in the Yeast the opening is very small. The cell-membrane itself grows forth as in the *Conferva glomerata*, and the gelatinous contents increase within; some of this matter can be detected, by means of iodine, in the nodule at the very commencement of the protrusion.

The cells of Yeast are composed of a cell-wall and gelatinous contents which become granular, and the granules again consist of cell-wall and gelatinous contents, therefore of cells; the cell-wall is probably identical with the cuticula of the Confervæ; the cellulose layer is wanting in the Yeast, and in the Confervæ the primordial utricle which H. von Mohl has pointed out in other cells does not occur.

The deposition of starch takes place in the Confervæ, as in other plants, when the usual process of development in the cell is not so active or is hindered, and it ceases when this process begins again*.

The remainder of the paper relates to the chemical analyses of the different portions of the Conferva; but it will be more interesting to consider here the relations of the observations brought

* Starch is not usually formed abundantly in cells until they have ceased to grow. Indeed the formation of starch and the process of growth may be regarded as directly opposed phænomena, one being the accumulation of nutrient matter, the other the consumption of it.—A. H.

forward in the preceding pages to the investigations of other inquirers.

In the first place, with regard to the action of sulphuric acid and iodine upon the various membranes, H. von Mohl* has shown that this depends more upon the age of the structure than anything else. He finds that these reagents produce the blue colour in young cell-membrane, and that the older structures which are usually coloured brown, are brought into a condition to acquire the blue tint with iodine by boiling in nitric acid or solution of potash; and this without destroying the membrane, at all events without converting it into starch, since it remains insoluble in boiling water. He finds solution of potash produce the effect best in epidermal structures; nitric acid in the ligneous tissues. It is uncertain whether this altered condition of old tissues depends on spontaneous alteration or the penetration of the tissue by new substances. Unger† also states that these structures which are usually coloured brown by iodine may be made to acquire the blue colour by boiling in concentrated sulphuric acid. These observations show that mere chemical reaction is not sufficient to determine the physiological nature of the tissue. The outer layer, which Prof. Mitscherlich calls the *cuticula,* is apparently the wall of the original cell; the new cell-walls do not form part of it, being deposited on its interior in successive layers, with which the new septa are continuous.

With regard to the process of division many modifications of opinion exist; almost all recent observers however agree in attributing the principal influence to the substance which Prof. Mitscherlich calls the *gelatinous mass.* This is the *Schleim* of most German authors, translated by many English authors as *mucus,* and by myself always as *mucilage* or *mucilaginous matter*; a bad term, and one which it would be desirable to replace universally by the one proposed by H. von Mohl, *Protoplasm,* which involves no theory of its chemical nature, but certainly is correct in the view it assumes of the function of this matter. Some German authors apply the general term of *Inhalt* or *cell-contents* to it: it is the *cytoblastema* of Schleiden and the *endochrome* of other authors.

Kützing‡ holds that this protoplasm is enveloped in a special membrane, which he calls the *amylid-zelle.* H. von Mohl§ de-

* Ueber das Wachsthum der Zellmembran. Bot. Zeitung, vol. iv. p. 337, 1846.—Translated in Annals of Nat. Hist. Ser. 1. vol. xviii. p. 145, 1846. Untersuchung der Frage: Bildet die Cellulose die Grundlage sammtlicher vegetabilischen Membran? Bot. Zeitung, vol. v. pp. 497, 521, 545, 1847.

† Die Intercellularsubstanz und ihr Verhältniss zur Zellmembran bei Pflanzen. Botanische Zeitung, vol. v. p. 289, 1847.

‡ Linnæa, 1841, p. 546.

§ Beiträge zur Entwickelungsgeschichte der Pflanzen. Botanische Zeitung, vol. i. 1843.—Translated in Taylor's Scientific Memoirs, vol. iv. p. 91.

scribes such a structure under the name of the *primordial-schlauch*, which I have translated and adopted in my own researches under the name of *primordial utricle*. Unger* also takes the same view. Nägeli maintains that there is no special membrane inclosing the cell-contents, and like Prof. Mitscherlich he believes that the appearances which the protoplasm presents when coagulated on the surface have deceived the above observers. My own observations† have led me to agree with H. von Mohl, and the independent membranous nature of the primordial utricle is also asserted by K. Müller‡.

The action of the protoplasm in the production of the septum in cell-division is therefore either immediate, as asserted by Nägeli §, who declares that it secretes the new membrane or thickening layers, as the case may be, or it is the investing membrane of the protoplasm, the primordial utricle, on the surface of which the new deposits are formed and moulded.

Nägeli says, that the protoplasm divides into two complete portions, at once, and deposits the septum, perfect, though as yet very thin. Unger also describes the division of the primordial utricle as being effected at once, and the formation of the whole septum as simultaneous.

It has just been seen that Prof. Mitscherlich holds the formation of the septum to be progressive ||, and H. von Mohl¶ describes and figures the whole series of stages which he saw, and which convinced him that the process of formation proceeds from the periphery to the centre; that the primordial utricle gradually folds in, and secretes the cell-membrane as it advances. My own observations** agree with this view, and it is principally supported by what I saw in common with H. von Mohl, namely the continuation of the cell-contents through the imperfect septum. However Nägeli states that this appearance is produced by the adherence of the contents to the centre of the septum. On the other hand, I believe with Von Mohl that the conclusion that the contents are divided into two parts at once may be founded on an error caused by the action of reagents, which when they cause the protoplasm and primordial utricle to contract violently, also frequently produce a rupture across the isthmus which connects the contents of the two parts of the dividing cell.

* *L. c. supra.*

† Ann. of Nat. Hist. Ser. 1. vol. xviii. p. 364, 1846.

‡ Zur Entwickelungsgeschichte der Charen. Botanische Zeitung, vol. iii. 1845.—Translated in the Ann. of Nat. Hist. Ser. 1. vol. xvii. 1846.

§ Zellenkerne, Zellenbildung, &c. Zeitschrift für Wiss. Bot., Heft 1 & 3. The former paper is translated in the Ray Society's publications, 1845.

|| Prof. Mitscherlich does not attribute any function to the cell-contents.

¶ Vermisch. Schrift. p. 363, 1845.

** Ann. of Nat. Hist. *l. c.*

I may add to the above, in conclusion, that the opinions of observers are becoming more and more in favour of the view, that multiplication by cell-division is the regular mode of increase in *vegetating* or *growing* parts. Nägeli* asserts it in his most recent publications, and Unger † considers that it is the mode of increase in the cambium layer or *growing region* of wood. On the other hand, Mohl, Müller, Nägeli and many other authors, agree that spores, pollen and embryos are produced by free cell-formation from nuclei.

XLVII.—*Descriptions of* Aphides. By Francis Walker, F.L.S.

[Continued from p. 345.]

Eighth Group.

The following species is one of the most beautiful of the British Aphides, and is distinguished from all other kinds by its peculiar structure.

17. *Aphis Juglandis*, Frisch.

Aphis Juglandis, Frisch, Ins. xi. pl. 16. f. 1, 5.
Lachnus Juglandis, Kalt. Mon. Pflan. i. 150. 3.

The viviparous winged female. It feeds from July to October on the leaves of the walnut, *Juglans regia*, and is stationed in clusters along the middle vein of the upper side of the leaf. The body is pale orange: the head is darker, and rather short and broad: the front forms an angle where it retreats on each side, and is slightly concave in the middle: the feelers are filiform, and a little more than one-fourth, or sometimes full one-third, of the length of the body; the fourth joint is much less than half the length of the third; the fifth is a little shorter than the fourth; the sixth is less than half the length of the fifth; the seventh is much shorter and more slender than the sixth; the tips of these joints are black: the eyes are red: the mouth reaches to the middle hips; its tip is black: the discs of the chest and of the breast are black: the sides of the fore-chest are notched: the abdomen is rather large, and sometimes it contains upwards of thirty young ones which are all of the same size: the nectaries are extremely short, and less than one-twentieth of the length of the body: in the pupa there are four rows of brown spots along the back of the abdomen; the middle rows, which are confluent in the winged insect, have a short and slender transverse brown line on each interval between the spots: the fore-legs are much shorter than

* Zeitschrift für Wiss. Botanik, Heft 3, 1847. † *L. cit.*

the hind-legs, which are rather long and stout; the shanks are nearly straight: the wings are colourless and of moderate size; the veins are brown and strongly marked; their borders are clouded with brown; the space between the rib-vein and the fore-border of the wing is clouded as far as the brand, which is irregularly spindle-shaped, and for the most part colourless; the first and the second branch-veins are nearly straight; the third is distinct at its source, inclined inwards, and forms two very obtuse angles where it throws off its forks; the first fork begins soon after one-third, the second long after two-thirds, of the length of the vein: in the hind-wings the space between the vein and the fore-border is clouded for more than half the length of the wing; the tips of the other veins are also clouded: the feet, the tips of the shanks, and the tips of the hind-thighs are brown; there is also a slight brown mark at the tip of each of the other four thighs.

Length of the body 2 lines; of the wings 5 lines.

The oviparous wingless female. Found at the end of October. The body and the limbs are hairy; the former is pale orange, and spindle-shaped: the head is black, slightly varied with orange, hairy in front: the breast is pale yellow: there are four rows of black spots along the back, the middle rows consisting of long transverse spots, some of them confluent along the back of the abdomen; there is also a transverse row of four narrow black streaks on each interval between the large spots: the abdomen beneath is orange; its tip is yellow and its sides are varied with alternate spots of pale yellow and black: the spots on the chest are larger than those on the abdomen, and sometimes all the spots on the latter are nearly confluent: the feelers are yellow with black tips, and about one-fourth of the length of the body: the legs are pale yellow; in the hind-legs the tips of the thighs, the shanks except their tips, and the feet except the middle part, are black.

The winged male. This also appears at the end of October, and much resembles the winged female: the head and the abdomen are orange, and the latter has some short black bands on its back, those towards the tip are interrupted: the feelers are black, yellow at the base, and about half the length of the body: the wing-ribs are pale yellow: the wing-brands are brownish black.

Ninth Group.

18. *Aphis bifrons*, n.s.

A single insect found near London on the 20th of July, 1847, on the alder?

The viviparous winged female. The body is yellowish brown and thickly covered with white powder: the head short and broad: the

forehead broad, very slightly convex, with a little tubercle on each side at the base of the feelers: the eyes are dark brown and prominent: the mouth reaches the hind-shanks: the chest and the breast are dark brown; the fore-part paler: the feelers are setaceous, more than half the length of the body; the fourth joint a little shorter than the third; the fifth a little shorter than the fourth; the sixth full half the length of the fifth; the seventh a little shorter than the fifth: the nectaries do not appear above the surface of the abdomen: the legs are tawny, long and rather stout; the knees, the feet, and the tips of the shanks are dark brown; the shanks are very slightly curved; the fore-legs are a little shorter than the hind-legs: the wings are colourless, and not very long; the veins and the wing-brands are tawny; the brands are irregularly spindle-shaped; the rib-veins widen gradually into the brands very soon after the middle of the fore-border of the wing; the fourth vein springs from hind-border of the brand at three-fourths of the length of the latter; the third vein is distinct along its whole course, and is forked a little before one-third of its length, and forked again just after two-thirds of the same.

Length of the body $1\frac{1}{4}$ line; of the wings 4 lines.

Tenth Group.

19. *Aphis Populi.*

Aphis Populi, Linn. Syst. Nat. ii. 736. 27; Faun. Suec. 996; Fabr. Ent. Syst. iv. 216. 27; Syst. Rhyn. 298. 27; DeGeer. Ins. iii. 94. 15. tab. 7. f. 1–7; Kalt. Mon. Pflan. i. 126. 98; Ratz. Forst. Ins. iii. 218. 16.

Myzægirus, Amyot, Ann. Soc. Ent. Fr. 2me série, v. 479.

The viviparous wingless female. It is pale yellowish green, oval, and hairy: there are irregular stripes of darker green along the abdomen: the feelers are pale yellow, and shorter than the body; their tips are brown: the mouth is pale yellow; its tip is brown: the eyes are dark brown: the nectaries are brown, and less than one-twelfth of the length of the body: the legs are pale yellow, and moderately long; the feet and the tips of the shanks are brown. It is surrounded by its offspring which are almost white, and prettily mottled with green. In the middle of June 1846 beneath the leaves of *Populus nigra*, the black poplar, and *P. dilatata*, the Lombardy poplar.

1st variety. This is smaller than the preceding, and when young is pale dull green with a bluish line on each side, oval, convex, slightly pubescent: the head, a large spot on each side of the fore-chest, the feelers, the mouth, the nectaries, and the legs are blackish green: the feelers are less than one-third of the length of the body: the eyes are dark brown: the nectaries are

not more than one-twentieth of the length of the body. Beneath the leaves of *Populus alba*, the white poplar, a little before the middle of April. In the beginning of June when full-grown it is pale green, varied with vivid green, and is hairy, oval, and rather flat: the feelers are pale green, shorter than the body; their tips are brown: the eyes are black: the mouth is pale green; its tip is brown: the nectaries are very short: the legs are pale green, and moderately long; the feet and the tips of the shanks are brown.

There are often two interrupted brown lines along the back; these lines vary in breadth and distinctness, and sometimes occupy the greater part of the back; they occasionally occur only on the head and on the fore-part of the chest. The young ones have the front convex in the middle: the broods are less numerous in this species than in the kinds with long nectaries: the little ones before birth are of various sizes, and the smallest do not exceed the size of the heads of the largest.

The oviparous wingless female. In colour it resembles the viviparous wingless female: the feelers are not more than one-half, or sometimes than one-third, of the length of the body, which is more or less lengthened towards the tip: the hind-shanks are slightly dilated and of a rather darker colour than the other shanks: the fore-chest, like that of the male, has a dark spot on each side. Its eggs are three or four in number.

The viviparous winged female. Black, and rather small: the fore-border, the hind-border and the underside of the fore-chest are dark green: the abdomen is green, and has an interrupted black band across the back of each segment, and a line of black dots along each side: the feelers are black, pale yellow towards the base, and shorter than the body: the eyes are black: the mouth is dull green: the nectaries are black, and hardly one-twelfth of the length of the body: the legs are pale yellow and moderately long; the knees and the tips of the shanks are brown; the hind-thighs are black: the wings are colourless, and much longer than the body; the wing-ribs are pale yellow; the wing-brands and the veins are black, and the latter are slightly clouded.

1st variety. Smaller than the preceding: the abdomen and the underside of the fore-chest are pale green: the feelers are pale brown, pale green at the base, and a little shorter than the body: the mouth is pale green with a black tip: the legs are pale green: the wing-brands and the veins of the wings are brown. On *Populus alba*, the white poplar, in the beginning of June.

At the end of August it much resembles the male in colour, and sometimes, as in that sex, the wing-brand extends beyond the rib-vein which passes through it, and the zigzag line men-

tioned in the description of the male indicates the border of the brand.

The pupa is elliptical, and of a bright yellow colour.

The winged male. It acquires wings early in October, and its deep red or crimson-coloured pupæ may be seen for some time previously feeding here and there among the viviparous and oviparous females. The head is broader than the chest: the front is armed with bristles, slightly concave in the middle, and retreating on each side: the eyes are prominent: the feelers are setaceous, and as long as the body; the fourth joint is much more than half the length of the third; the fifth is much shorter than the fourth; the sixth is a little more than half the length of the fifth, and increases in breadth from its base to its tip; the seventh is rather longer than the fourth, and is much more slender than any of the preceding joints: the fore-chest is rather broad and short; its length is one-fourth of its breadth; the sides are convex and not notched: the nectaries are not more than one-twentieth of the length of the body: the legs are rather short and stout; the shanks are very slightly curved: the wings are long and colourless; the veins are brown; the wing-vein does not widen into the brand, but passes along its hind-border which is very slightly curved, and not angular; it is spindle-shaped; the veins are strongly marked; the first and the second branch-veins are near together at the base, the first is straight, the second is slightly curved; the third is obsolete at its source, and is forked before one-third, and forked again before two-thirds of its length, and it forms two very slight obtuse angles where it casts off its forks; a very slender zigzag line runs along the brand at a short distance from its hind-border; the fourth vein is unusually long. The body is yellow: the feelers, except the base of the third joint, the tip of the mouth, the disc of the chest and that of the breast, and the four hinder thighs, are brown: the eyes are red; the wing-brands are brown. Irregularities in the wing-veins:—1st, The fourth vein is curved towards its tip. 2nd, The tip of the lower branch of the first fork, and the tips of both branches of the second fork are wanting. 3rd, The lower branch of the second fork is obsolete.

Length of the body $\frac{3}{4}$–$1\frac{1}{2}$ line; of the wings $2\frac{1}{2}$ lines.

This species may be found from June till October, but is not abundant till the autumn, when the winged female disappears; but the viviparous wingless female is common in October, the season for the pairing of the male with the oviparous female.

20. *Aphis hirticornis*, n. s.

The viviparous winged female. The body is dull dark buff: the disc of the head and that of the chest are brown: the feelers are

slender, setaceous, hairy, and as long as the body; the fourth joint much shorter than the third; the fifth is a little shorter than the fourth; the sixth increases in breadth from the base to the tip, and is not half the length of the fifth; the seventh is as long as the sixth, and much more slender than the preceding joints: the front of the head is nearly straight, and has no tubercles: the tip of the mouth is brown, and reaches the middle hips: the sides of the fore-chest are convex: the nectaries are about one-twentieth of the length of the body: the wings are colourless; the veins and the wing-brands are pale brown; the rib-veins widen into the brands which are irregularly spindle-shaped, and form on the hind-border a scarcely perceptible angle from whence springs the fourth vein; the first and the second veins are nearly straight; the third vein is slightly inclined inwards, and forms two very obtuse angles where it throws off its forks; the first fork begins after one-third, and the second fork before two-thirds of the length of the wing; the two forks are sometimes much nearer to each other in one wing than in the other: the legs are yellow, and moderately long; the shanks are very slightly curved, and rather hairy; the tips of the feet are brown.

Length of the body $1\frac{1}{4}$ line; of the wings 3 lines.

July, on the oak, near London.

Eleventh Group.

21. *Aphis Aceris*.

Aphis Aceris, Linn. Syst. Nat. ii. 7361; Faun. Suec. 999; Fabr. Syst. Ent. 735. 9; Sp. Ins. ii. 385. 10; Ent. Syst. iv. 211. 11; Syst. Rhyn. 295. 11; Gmelin, ed. Syst. Nat. i. 2208; Geoffr. Ins. i. 495. 5; Reaum. Ins. iii. 281–350. t. 22. f. 6–10; Scopoli, Ent. Carn. 137. 397; Enc. Méth. i. t. 116. f. 6; Rossi, Faun. Etrusc. 260. 1372; Schrank, Faun. Boic. ii. 1. 111; Fonscolombe, Ann. Soc. Ent. x. 173. 13; Kaltenbach, Mon. Pflan. i. 125; Ratzeburg, Forst. Ins. iii. 218.

Acerifex, Amyot, Ann. Soc. Ent. Fr. 2me série, v. 479.

This species abounds on the different species of maple, such as *Acer Pseudo-platanus*, the sycamore; *A. Platanoides*, the plantain-like or Norway maple; *A. campestre*, the field maple; *A. opalifolium*, the guelder rose-leaved maple; *A. Monspessulanum*, the Montpelier maple; *A. tataricum*, Tartarian maple; *A. Negundo*, ash-leaved maple.

The egg-born viviparous wingless female. It is hatched in the middle of February or later, and is then very small, black, bristly, linear, or slightly increasing in breadth towards the tip of the abdomen: the limbs are short and thick: the mouth reaches a little beyond the tip of the abdomen, a character retained through

life by some species of *Aphis* : the nectaries do not rise above the surface of the body. In March it increases in size, sheds its skin, is broader than before, and of an olive-green colour, with a large pale green spot by each of the nectaries which are dark brown : there are four rows of large tubercles along the back, and some of smaller size intermixed : the feelers are pale green, darker towards their tips, or nearly brown, and not one-fourth of the length of the body; the fourth joint is much shorter than the third; the fifth is as long as the fourth; the sixth is a little shorter than the fifth, and the seventh has the same proportion to the sixth : the front is convex : the mouth does not reach beyond the hind-hips.

The viviparous winged female. The pupæ of this generation appear in April, and are very variable in colour, in breadth, and in outline; the colour varies between bright pale yellow with a slight green tinge or with two green stripes along the back, pale green, dark green with black spots, red, and brown; the back is covered with bristles, and the underside is sometimes black : the feelers are more or less than half the length of the body; their tips, the feet, the tips of the shanks and the hind-thighs are brown; the latter are sometimes red; the shanks are sometimes yellow : the nectaries are pale green with brown tips, and vary from one-twelfth to one-twentieth of the length of the body. The wings are unfolded soon after the middle of April, and when this process has just occurred the fly is pale green, but afterwards the crown of the head and the disc of the chest become black : the body is bristly, especially the abdomen, which has a black band across each segment both above and below; the feelers are black or brown; they have a broad yellow band at the base, and are more than half the length of the body; the fourth joint is more than half the length of the third; the fifth is a little shorter than the fourth; the sixth is spindle-shaped, and hardly half the length of the fifth; the seventh is much more slender than the sixth, and more than twice or thrice its length : the eyes are dark brown : the mouth and the nectaries are black : the legs are pale yellow and bristly; the feet and the tips of the thighs and of the shanks are brown or black, which last colour is most prevalent in the four hinder legs whose thighs are sometimes nearly all black : the wings are colourless, and much longer than the body; the wing-ribs, the wing-brands and the veins are buff, brown, green, or pale straw-colour. The colour of this insect for a short while after it sheds its skin is a most delicate green or yellow inclining to white, and resembling that of some very young leaves, but more beautiful. At the end of September this winged Aphis is black : the abdomen is dark dull yellow; the disc of its back except the sutures is black, and there is a row of black d o

on each side: the feelers are nearly as long as the body: the mouth is dull yellow; its tip and the nectaries are black, and the latter are one-tenth of the length of the body.

The second form of the viviparous wingless female. The winged mother in the beginning of June gives birth to a large progeny of pale green young ones; these are covered with long white hairs, and have white limbs and brown eyes; they sit in clusters beneath the sycamore leaves; the number in each group varies from ten to some hundreds, and they continue thus without any increase of size for three months or longer; they are arranged with their heads converging towards the centre of the group. There is a thin membrane or rim or edge round the body: the eyes are red: the mouth reaches a little beyond the hind-hips; its tip is brown: the feelers are more than half the length of the body: the legs are rather short and stout. In September an alteration takes place; the body increases in size, becomes more and more plump, and much less hairy, and its rim ceases: the fourth joint of the feelers is about half the length of the third; the fifth is as long as the fourth; the sixth is much shorter than the fifth; the seventh is rather more than twice the length of the sixth. I have found the full-grown viviparous wingless female on the maple in August, but its occurrence then and during the preceding month is uncommon: the body is rather narrow, but rapidly increases in breadth towards the hinder part: the back and the limbs are hairy, and the feelers are nearly as long as the body; the fourth joint is much shorter than the third; the fifth is very nearly as long as the fourth; the sixth is not half the length of the fifth; the seventh is longer than the fifth. Both the wingless and the winged viviparous females in October resemble those of the preceding generations: the forehead is slightly convex, rather bristly, and has no tubercles at the base of the feelers: in the winged insect the seventh joint of the feelers is longer than the fifth: the third wing-vein sometimes sends forth its second fork before two-thirds of its length.

The oviparous wingless female. This appears in the autumn, and when very young is pale yellow; it acquires its full size during October, and at an early period of the growth two deep green spots appear on the back, and afterwards there are two brown stripes along the back, having a buff space between them, and sending forth on each side a short branch to the border of the abdomen which is much broader than the chest; these stripes are sometimes very uneven, or broken, or various in shade and in tint; the colour of the whole body is also variable, being yellow, or brown, or green varied with black, or almost black: it contains eight large full-grown eggs which quite fill the body even to the fore-chest: the abdomen is lengthened or drawn out towards

the tip: the feelers are hardly half the length of the body; the fourth joint is much shorter than the third; the fifth is a little shorter than the fourth; the sixth is more than half the length of the fifth; the seventh is a little longer than the fifth: the fore-legs are not much shorter than the hind-legs; the hind-shanks are slightly curved, tawny, and darker than the other shanks.

The winged male. This may be found from the middle of October till November: it is like the winged female with the exception of the following particulars:—the abdomen is dark green, and has a row of large transverse black spots along its back, and one of black dots on each side: the feelers are thick till near their tips: the legs are yellow; the hind-thighs from the middle to the tips, the knees, the feet, and the tips of the shanks are black. The feelers are scarcely hairy, and much shorter than the body; the fourth joint is much shorter than the third; the fifth is a little shorter than the fourth; the sixth is rather more than half the length of the fifth; the seventh is as long as the fifth; the wing-brand is irregularly spindle-shaped, and gradually widens soon after the middle of the wing; the fourth vein springs from a little beyond the middle of its hind border; the third vein is obsolete for some distance from its source, it is forked at one-third and forked again just after two-thirds of its length; the second vein is also obsolete before its source: the legs are hairy; their shanks are straight.

Length of the body $1\frac{1}{2}$—2 lines; of the wings 4 lines.

22. *Aphis Acericola*, n.s.

The viviparous winged female. Found on the sycamore at the end of May and in the beginning of June. The body is black, and rather long: the fore-border and the hind-border of the fore-chest are green: the abdomen is grass-green, and has a row of black spots on each side; the disc of its back is black, but traversed by narrow green bands: the nectaries are black, and about one-fifteenth of the length of the body: the legs are pale yellow, and moderately long; the feet are darker: the wings are colourless, and much longer than the body; the wing-ribs are pale yellow; the wing-brands are black; the veins are black. In other characters it resembles *Aphis Aceris*.

Length of the body $1\frac{1}{2}$ line; of the wings 4 lines.

Twelfth Group.

23. *Aphis Populea.*

Aphis Populea, Kaltenbach, Mon. Pflan. i. 116. 90.
Lachnus punctatus, Burm. Handb. Ent. ii. 93. 5.

The viviparous wingless female. This insect sometimes occurs near London in the summer on the twigs of the Lombardy pop-

lar, *Populus dilatata*, and of the willow-tree, *Salix alba, vitellina* and *caprea*; it is fixed there in dense masses, and each row overlaps the one below it. Large companies of ants (*Formica rufa*) are continually passing up and down the trunks of the trees whereon it is stationed. The body is oval, rather flat, hairy, and of a very dull yellow colour, and thickly covered with gray powder: the front is broad and slightly convex: the feelers are setaceous, hairy, and much less than half the length of the body; their tips are dark brown; the fourth joint is less than half the length of the third; the fifth is full as long as the fourth; the sixth is little more than half the length of the fifth; the seventh is much longer and more slender than the sixth: the mouth reaches the hind hips; its tip is dark brown: there are six rows of dark spots along the back: the nectaries are yellow, and not more than one-twentieth of the length of the body: the legs are stout and rather hairy; the fore-legs are much shorter than the hind-legs; the feet, and the tips of the shanks and of the hind-thighs are dark brown: the body contains about twenty young ones of various size.

The viviparous winged female. This has much resemblance to the viviparous wingless female: the sixth joint of the feelers is much less than half the length of the fifth: the discs of the head, of the chest, and of the breast are dark: the wings are colourless, and of moderate size; the veins and the brand are tawny; the rib-veins widen into irregularly spindle-shaped brands soon after the middle of the fore-border of the wing; the first branch-vein is nearly straight; the second is slightly curved; the third is inclined inwards, and forms two angles as usual; its first fork begins after one-third, and the second at two-thirds of its length; it approaches very near its source before it becomes obsolete.

Length of the body $1\frac{1}{2}$ line; of the wings 3 lines.

It is infested by an *Aphidius*, and is also devoured by the grubs of a *Syrphus* and of an *Agromyza*.

24. *Aphis Salicis.*

Aphis Salicis, Linn. Syst. Nat. ii. 736. 26; Faun. Suec. 995; Gmel. ed. Syst. Nat. i. 2207. 2210; Fabr. Syst. Ins. ii. 389. 46; Ent. Syst. iv. 219. 47; Syst. Rhyn. 301. 47; Reaum. Ins. iii. 281–350. t. 22. f. 2; Deg. Ins. iii. 50. 11; Schrank, Faun. Boic. ii. 1. 102. 1176; Rossi, Faun. Etrusc. 264. 1398; Kalt. Mon. Pflan. i. 131. 100; Ratz. Forst. Ins. iii. 218. 18.

Salicifex, Amyot, Ann. Soc. Ent. Fr. 2me série, v. 480.

The viviparous wingless female. Dull green, covered with white powder, rather flat, and increasing in breadth from the head till near the tip of the abdomen: there is a row of black spots on each side of the body: the sides are dull orange, and so disposed

as almost to form a tubercle on each segment: the fore-chest is large: the middle chest is rather shorter: the hind-chest and the following segments are much shorter and of nearly equal size: the feelers are slender, almost filiform, pale green at the base, brown at the tips, and less than one-third of the length of the body: the eyes are brown; the mouth is dull green: the nectaries are yellow, and about one-twentieth of the length of the body: the legs are dull green, long and stout; the feet are brown. In the middle of April on the shoots of the willow.

1st variety. Dull olive-green, varied with brown.

The viviparous winged female. The wings of this fly are unfolded before the middle of May: it is metallic black, and slightly covered with gray powder: the fore-breast and the underside of the abdomen are grayish green, and the back of the latter has alternate bands of black and gray: the feelers are black, slightly setaceous, and hardly half the length of the body; the fourth joint is much shorter than the third; the fifth is a little shorter than the fourth; the sixth is shorter than the fifth; the seventh is a little longer than the sixth: the mouth is dull green with a darker tip, and reaches a little beyond the base of the hind-legs: the eyes are black: the nectaries are orange and extremely short: the legs are black, long and stout; the thighs towards the base, and the shanks except their tips are dark red: the wings are colourless, and longer than the body; the wing-ribs are pale yellow; the wing-brands are long, and dull buff; the veins are brown; the rib-vein does not widen into the brand, but passes along its hind-border; the first and the second veins are nearly straight; the third is obsolete at its source, and is inclined inwards, and forms two very slight obtuse angles where it throws off its forks; the first fork begins soon after one-third, the second soon after two-thirds of the length of the wing: the legs are rather stout, and long, and hairy.

Length of the body 2 lines; of the wings $3\frac{1}{2}$ lines.

Thirteenth Group.

Containing one species which seems to be always wingless.

25. *Aphis Salicivora,* n. s.

The viviparous wingless female. The body is oval, flat, hairy, and yellow: the hairs on the sides of the body are very long: the front is hairy and slightly convex, and has no tubercles: the feelers are slender, setaceous, and nearly as long as the body; the fourth joint is much shorter than the third; the fifth is fully as long as the fourth; the sixth is shorter than the fifth, and increases in breadth from the base to the tip; the seventh is much

more slender than the preceding joints, and is rather longer than the fifth and the sixth joints together: the eyes are red, and rather prominent: the tip of the mouth is brown, and reaches the middle hips: the nectaries are very short, and not more than one-twentieth of the length of the body: the legs are rather short; the tips of the feet are brown.

1st variety. The feelers are less than half the length of the body.

The oviparous wingless female. The body is spindle-shaped, and contains two eggs: the feelers are rather less than half the length of the body: the hind-shanks are not dilated.

The wingless male. It has a narrower body, and longer and stouter legs than the female: the body is nearly linear, and obtuse at the tip: the feelers are much stouter than those of the female; the fifth joint is shorter than the fourth; the sixth is much shorter than the fifth.

Length of the body $\frac{1}{3}$–$\frac{1}{2}$ line.

Sometimes above eight hundred insects of this species feed together under a single leaf of the willow, *S. caprea,* from the beginning of May till the end of October, the latter month being the time for the appearance of the male and of the oviparous female.

[To be continued.]

XLVIII.—*Corrections of "Critical Remarks on* Mr. Gray's *Catalogue of Mammalia and Birds presented by* B. H. Hodgson, Esq., *to the British Museum," Ann. and Mag. N. H.* vol. xx. p. 313. By E. Blyth, Curator to the Museum of the Asiatic Society, Calcutta.

Page 313. *Presbytis priamus* does not inhabit Ceylon, but the *entelloid* group of monkeys is represented over the low northern half of that island by a peculiar species, of which Dr. R. Templeton (late of Colombo) has favoured me with a living adult male, which I have since figured and described by the name *Pr. thersites*, Elliot (J. A. S. B. xvi. 1271). I have given coloured figures also of *Pr. entellus* (verus), *Pr. priamus, Pr. hypoleucos, Pr. Johnii, Pr. cephalopterus* (three varieties of colour), *Pr. pileatus* and *Pr. Phayrei.* There is another large monkey in Ceylon, peculiar to the elevated and colder parts of the island*, which remains to be examined, but would seem to be very probably *Pr. Johnii,* which is common in the Neilgherries; and Dr. Templeton assures me of the existence of a small monkey probably undescribed,—all additional to the well-known *Pr. cephalo-*

* See Major Forbes's 'Journal of Eleven Years' Residence in Ceylon,' ii. 144.

pterus and *Macacus sinicus* (or the *Wándura* and *Kálawi* of the Cinghalese *).

The Tibetan Lynx I have since described by the name *Felis isabellina*: vide J. A. S. B. xvi. 1178.

P. 314. For *Sorex Perrotellii* read *S. Perrotettii.*

P. 317. *Sylvia indica,* Jerdon, proves to be my *Phylloscopus griseolus,* which must therefore now stand as *Ph. indicus* (Jerdon): while my *MS.* name *flaveolus* (cited by Mr. Gray) refers to the species which was named *Motacilla affinis* by Capt. Tickell.

P. 319. For *Staparola* read *Stoparola.*

P. 321. For *Emberiza sinops* read *oinops.*

Mirafra assamica, M'Clelland and Horsfield, v. *Plocealauda typica,* Hodgson, has another synonym (apud Jerdon), it being the *Alauda mirafra,* Temminck.

P. 323. *Phalacrocorax leucotis,* nobis, is the *Graculus sinensis* (Lath.).

P. 383. For *Toontoonu* (native name) read *Toontoonee,* or *Túntúni.*

P. 384. For *Tas-feek* (ditto) read *Tao-feek.*

P. 386, l. 14. After the word "individuals" insert *of Halcyon smyrnensis.*

I find that though many females of *Palæornis pondicerianus* are black-billed, others have the upper mandible coral-red as in the male, and some again imperfectly so; the latter being probably a transitory stage from black to red. One in my possession had the upper mandible black for more than a year, when its colour changed rapidly to bright coral-red.

P. 387 *et seq.* Jungle-fowls. A remarkable fact which I have observed both in the wild *Gallus ferrugineus* (Gm.), and in *G. Sonneratii,* is that for two or three months in the year (earlier in the former than in the latter species), the nuchal hackles are replaced by a growth of short blackish feathers, nearly as in a pheasant but devoid of brilliancy. This I have seen in no race of domestic fowls, not even in the hybrids produced between the male *G. Sonneratii* and a common hen; the hackles of these, when shed at the moulting season, being immediately replaced by others like them. In a curious small Malayan domestic cock I have (without wattles), the hackles fall and leave the neck quite bare for a season, giving him a rather singular appearance.

Respecting the matrimonial arrangements of the wild *G. ferrugineus,* I have still been unable to satisfy myself whether they are monogamous (as Capt. Hutton affirms) or polygamous to a greater or less extent. Capt. Tickell well remarks: "They dwell in such deep and *tigerish* jungles as not to be easily watched. I have met with the males and females," he adds, "indifferently together—commonly one male to three or four females. I remark however that just now

* The *Inuus silenus,* which has been generally assigned to Ceylon, is unknown there in a state of nature, though inhabiting (as I have been assured) the neighbouring provinces of Travancore and Cochin, on the mainland of India.

(February) the hens occur occasionally in little bevies by themselves; and during a whole day's search we do not find more than a solitary cock bird, and then by himself. But these separations of the sexes are not proofs of monogamy or polygamy. The eggs are generally six to ten in number." Early in January I came upon a party of eighteen or twenty (driven together at least out of the jungle by the beaters); and the sexes in this instance were about equal in number. Mr. Skipwith writes me word, that he has made inquiries on this subject of several *shikárrees*, and was told that when the opportunity offers the cock is decidedly polygamous; "and I suspect," he adds, "this must be the case, from a fact that has repeatedly come under my own observation when shooting, that in every covey of birds there are two or three hens to every cock." Capt. Hutton states however that in the breeding season he has constantly found them paired; but this seems to have been in places where the species was not very numerous, the few pairs being widely scattered.

The following remarks on Jungle-fowl shooting may be here quoted from the 'Bengal Sporting Magazine' (for May 1837):—"The *Bhund Moorg*, or Jungle-cock, is pretty generally known to Indian sportsmen. It is found in almost every part of the country where there is jungle. Being however exceedingly shy, and frequenting the thickest cover, an elephant is necessary for this sport, though an occasional bird may be shot on foot. They sometimes rise in pairs, affording an easy right and lefter, though likely to flurry a young sportsman on first coming across them. I have always found that, on beating for jungle-fowl, the best place is to take up a position eighty or one hundred yards ahead of my coolies, and allow them to beat the birds towards me. They take a good charge of shot to kill them dead, and when they are only wounded will run a considerable distance. In this case, there is little chance of bagging the bird. On the Calcutta and Benares roads they are very plentiful, particularly at Oondah, Bancoorah, Chatua, Chundunkearee, Chass, and Goomeah—the last-named place especially.

"As the day breaks (on the line of march) you hear them crowing on all sides; at this early hour venturing to the skirts of the jungle to feed in the grain and rice *Khets*, but appearing always on the *qui vive*, and on your approach they immediately disappear. When accompanied with chickens, the sportsman (?) has the best chance of success, as they seldom forsake their young, and the *chuck, chuck* of the old hen directs to the spot where they are. The weight of a jungle-cock is about $3\frac{1}{4}$ lbs."

Such is the wild common fowl. The habits of one of the two Cinghalese species are thus noticed by Major Forbes:—"These Jungle-fowl are continually announcing their position by a shrill double call, which is somewhat like the cry of the partridge, but has no resemblance to the crowing of a 'domestic' cock*. This call, when com-

* The crow of *G. Sonneratii* is exceedingly different from that of *G. ferrugineus*, either wild or in any domestic variety,—a sort of *charráh-char'atcha*.

menced by one jungle-cock, is answered by every other within hearing; then, with hostile intent and alternate sounds of defiance, they gradually advance to their morning combat; they are even more pugnacious than their domestic brethren; and I have seen jungle-cocks, when replied to (apparently in a very different dialect) from the fowl-yard, advance within its precincts, and give battle to its champions. In taste their flesh resembles that of the pheasant: in appearance, the males are like the common red dunghill-cock, only with more glossy plumage, and a yellow spot in the centre of the red upright comb; the female is much smaller, and in colour resembles the heath-hen of the moors."

I know the species referred to by Major Forbes, and suspect it is that named *G. Lafayettei*; being distinct from that of which the hen is figured in Hardwicke's 'Illustrations' by the name *G. Stanleyi*, and which inhabits more elevated ground. The habits portrayed are very decidedly those of a polygamous species; and (equally with those before cited of *G. ferrugineus*) vividly recal to mind those of the British pheasant. And *G. Sonneratii* will answer and defiantly crow against a common fowl, however widely different its voice, the same as the Ceylon species; at least I speak of *G. Sonneratii* when tamed, but not domesticated, and which if he breaks loose is most readily recaptured by putting out a common domestic cock to entice him to combat.

P. 393. Is not *Turdus rufulus*, Drapiez, vel *modestus*, Eyton, identical with *T. javanicus*, Horsfield, vel *concolor*, Temminck?

As regards the *Lanius phœnicurus* and *L. superciliosus*, I may repeat my observation that the colouring characteristic of the latter is peculiar to the Malayan bird, common as *L. phœnicurus* is throughout India; but that what I now consider to be females or young males of the former are undistinguishable from the Indian *L. phœnicurus*. *L. tigrinus* is distinct altogether: and I may remark that I have lately described a beautiful new shrike from the Tenasserim provinces, which is very nearly allied to *L. Hardwickii*.

BIBLIOGRAPHICAL NOTICES.

Recherches sur les Animaux Fossiles, par L. de Koninck. Liége, 1847.
(*Première Partie, Monographie des Genres Productus et Chonetes.*)

This is the first of a series of works entitled 'Researches on Fossil Animals,' containing monographs of the genera *Productus* and *Chonetes*. These works are intended to supply the geologist and naturalist with complete monographs of different genera, so as to embody in one volume all the species of a genus which are now more or less distributed through many periodicals, memoirs and transactions of Societies. The first part contains a list of 107 works and memoirs to which the author has referred in the subsequent pages. To this

succeeds an historical introduction and observations on the generic characters, with a classification of the species. A detailed description of each species is given, to which is appended a very complete synonymy. From the geologic and geographic distribution which follows we extract a few notes. The number of species of *Productus* described amounts to 62, of which 4 are Devonian, 47 Carboniferous, 10 Permian, and 1 Triassic. Of the 47 Carboniferous species 35 only are found in the lower divisions, viz. :—

P. striatus.	P. proboscideus.	P. costatus.	P. fimbriatus.
— giganteus.	— genuinus.	— subquadratus.	— Buchianus.
— latissimus.	— Nystianus.	— brachythærus.	— Deshayesianus.
— flexistria	— Medusa.	— spinulosus.	— marginalis.
— mammatus.	— plicatilis.	— Villiersi.	— granulosus.
— arcuarius.	— Griffithianus.	— tessellatus.	— Orbignianus.
— porrectus.	— sublævis.	— Humboldtii.	— Verneuilianus.
— undatus.	— Boliviensis.	— pyxidiformis.	— Christiani.
	— expansus.	— Leuchtenbergensis.	

Not any species belongs exclusively to the middle division, although 7 are common to the lower and middle portions, viz. *P. margaritaceus, undiferus, Flemingii, pustulosus, Keyserlingianus, aculeatus, mesolobus.* The *P. carbonarius* is found only in the upper division. The *P. Cora, semireticulatus, scabriculus* and *punctatus* appear to have lived from the commencement to the close of the carboniferous period.

It is interesting to observe that all the Devonian species have common general characters, and may be arranged in the same group (Caperati) ; a similar remark also applies to the Permian species, which, with the exception of three, are nearly all comprised in the group (Horridi), so that the latter group is almost composed of Permian species, the *P. Orbignianus, P. Verneuilianus,* being the only carboniferous forms ; and it is not a little singular, in consulting the table of classification (page 29), to find that the Permian species have a much greater affinity with the Devonian than with the carboniferous, notwithstanding the considerable period which must have elapsed between their development.

Under the geologic distribution of the genus *Chonetes* we find there are 23 species known at present, which number may probably be increased when the fossiliferous deposits of America, New Holland and Asia are more explored. Nevertheless the geological results to which the known species lead us are deserving of notice. From the observations of M. de Koninck it appears (contrary to the opinion generally admitted), that with the exception of one, not any of the 23 species pass from one system to another, or even from the lower to the upper beds of the same system.

The following table shows their distribution in the different parts of the palæozoic series :—

Silurian.	*Devonian.*	*Carboniferous.*	*Permian.*
C. striatella.	C. Falklandica.	C. concentrica.	C. variolata??
— cornuta.	— sarcinulata.	— papilionacea.	
	— dilatata.	— comoides.	
	— crenulata.	— Shumardiana.	
	— nana.	— Dalmaniana.	
	— setigera.	— sulcata.	
	— armata.	— Buchiana.	
	— minuta.	— tuberculata.	
	— convoluta.	— variolata.	
		— elegans.	
		— Laguessiana.	
		— perlata.	

From the inspection of the above table, it appears that the genus *Chonetes* attained its greatest development in the carboniferous system; it is there also that the species present many varieties of form and are of the greatest size. This latter remark applies also to *Productus*, to which *Chonetes* is closely allied. However, the proportion in which this development has taken place is very different for the two genera. With regard to their distribution in time, the following conclusions are drawn from the table above quoted: the two Silurian species belong to the upper beds of the system; in the Devonian system the *C. Falklandica, sarcinulata* and *dilatata* characterize the inferior beds, the *C. crenulata, nana* and *setigera* are characteristic of the middle portion, and the *C. armata, minuta* and *convoluta* are found only in the upper beds of the same system. The *C. concentrica, papilionacea, comoides, Shumardiana, Dalmaniana, sulcata, Buchiana* and *tuberculata* belong exclusively to the inferior beds of the carboniferous system, the *C. elegans* to the middle, and the *C. Laguessiana* and *perlata* to the superior beds of the same system; and lastly, the *C. variolata* belongs to different carboniferous deposits, and appears even to pass into the Permian system.

In a memoir of this nature, it is almost impossible to attain absolute correctness, more especially from the author not having had the means of verifying all the species from original or well-authenticated specimens; independently, however, it is a work of great research, and will be of considerable value to the palæontologist, in placing before him carefully executed figures of the species belonging to these two genera. The volume is in quarto, illustrated by 20 plates, and contains also an alphabetical, synonymical and chronological table of all the species.

Monographia Heliceorum Viventium, sistens Descriptiones systematicas et criticas omnium hujus familiæ generum et specierum hodie cognitarum. Auctore Ludovico Pfeiffer, Dr. Cassellana. Fasc. 1,2,3. Lipsiæ, 1847–48.

It is with great pleasure we announce the appearance of the completion of the first volume of this excellent monograph, containing

the *Helices*. The author gives moderately long and complete comparative descriptions of 3 species of *Anostoma*, 2 *Tomigerus*, 24 *Streptaxis*, 6 *Proserpina*, and 1148 species of *Helix*, with their synonyma most carefully and completely elucidated. It forms one of the most important additions which have lately been made to the study of shells.

Malacologically considered, the work must be regarded as a retrograde movement: the author is a pure conchologist, belonging to the same school as Klein, Montfort and Schumacher, for he pays little or no attention to the animal, and even refuses to adopt genera formed on the study of them: if the same system was followed with regard to the marine mollusca, several groups which are now considered as families, each containing several generally adopted genera, must be reduced to a single genus. In the same manner, the immense number of kinds of *Helices* are arranged together in an artificial manner, without any attention to their relation to one another, which is more to be regretted, as Férussac in his 'Prodromus' arranged the species which he knew in most excellent natural groups; but Dr. Pfeiffer appears to be quite destitute of the faculty of distinguishing or characterizing natural groups, though he describes the species so well. It was the remarkable union of these qualities in the same individual which so eminently distinguished Linnæus, Jussieu and Lamarck from other naturalists, and causes the great value of their works.

A large proportion of the species are described from the English collections, and where the author has not observed the species himself, he quotes descriptions given by its original describers.

PROCEEDINGS OF LEARNED SOCIETIES.

LINNÆAN SOCIETY.

Feb. 15, 1848.—The Lord Bishop of Norwich, President, in the Chair.

Read a memoir "On the early stages of the Development of *Lemanea fluviatilis*, Agardh." By G. H. K. Thwaites, Esq. Communicated by the Rev. M. J. Berkeley, F.L.S.

Mr. Thwaites attributes the neglect of the early condition of this conferva to its having been confounded in this stage with *Trentepohlia pulchella β. chalybea*, Harv., with which it is frequently found growing intermingled. He states that it may be observed in great abundance towards the end of November, covering the surface of stones with a uniform, dark olive, somewhat villous coating, and adhering with great pertinacity by means of its minute roots. The structure of the plant at this early stage is found to consist of numerous conferva-like filaments, of about a line in length and sparingly branched. Each filament is about $\frac{1}{1100}$th of an inch in diameter, and consists of a single row of cells, which are from 4 to 6 times longer than wide, and have a blue-green endochrome arranged

in a spiral manner, except in the terminal cells, where it is more abundant and gives them a darker colour. This stage Mr. Thwaites regards as analogous to the confervoid filaments which form the primordia of a moss, or to the mycelium of a fungus; and he adds that Kützing has described and figured the early condition of *Lemanea torulosa*, Agardh, as very similar.

From a cell near the base of this conferva-like structure a branch is given off, which at first differs apparently from the ordinary branches only in its cells being much shorter. This little branch increases rapidly in length and thickness from the multiplication of its cells by fissiparous division; and to enable it to acquire a firmer support, a number of roots are given off from its base (in the same manner as in the *phyton* of a moss), and it is thus enabled to attach itself and maintain an independent existence. From this period it gradually puts on the well-known characters of the full-grown *Lemanea*.

Mr. Thwaites believes that the study of the early development of the *Algæ* would well repay the careful observer. He thinks it highly probable that very many of the structures now classed with the *Palmellæ* are merely immature states of more complicated species; but he recommends great caution in such investigations, as without a good microscope and a practised eye, very essential characters readily escape detection.

Read also a portion of Dr. Buchanan Hamilton's Commentary on the 9th Part of Van Rheede's *Hortus Malabaricus*.

March 7.—The Lord Bishop of Norwich, President, in the Chair.

Read a memoir "On *Melianthеæ*, a new natural order of plants, proposed and defined by J. E. Planchon, docteur-ès-sciences." Communicated by the Secretary.

After an introductory critical sketch, the author proceeds to compare together *Melianthus*, *Diplerisma* (a new genus founded upon *Melianthus minor*, L., and *Mel. comosus*, Vahl), *Natalia* and *Bersama*; that is to say, the four genera which he proposes to unite under the common name of *Melianthеæ*. This comparison includes chiefly descriptive details, of the results of which the following synoptical table will afford a summary view:—(*See the Table on pp.* 462–3.)

A glance at the characters suffices to show that those among them which are common to all the genera are also of undoubted primary importance in most natural tribes. So, for instance, the structure of the seeds, the relative position and numerical proportion of the floral parts, the position and even the shape of the disc, the pinnate leaves and the constant presence of stipules, are so many points by which the connection of these plants is established. Admitting then the homogeneity of the order, the author proceeds to point out its more general affinities.

	Ord. MELIANTHEÆ, *Planch.*			
	Sect. 1. Eumeliantheæ.		Sect. 2. Bersameæ.	
	Genus 1. Melianthus, *L.*	Genus 2. Diplerisma, *Planch.*	Genus 3. Natalia, *Hochst.*	Genus 4. Bersama, *Fresen.*
Vegetation	Shrubs, half herbaceous	Shrubs	Small trees	Small trees.
Facies	Like *Rosaceæ—Agrimonieæ*	Like *Rosaceæ—Agrimonieæ.*	One species like *Paullinia pinnata.*	Nothing strictly peculiar.
	Glaucous, glabrous	With a short, adpressed, whitish down.		
Leaves	Alternate, imparipinnate	Alternate or subopposite	Alternate, imparipinnate	Alternate, imparipinnate.
Stipules	One large intrapetiolar (made up of two).	Two free, lateral	One small intrapetiolar (made up of two).	One small intrapetiolar (made up of two).
Inflorescence	Racemes simple	Racemes simple	Racemes simple	Racemes simple.
Bracteæ	Large	Large	Small	Small.
Flowers	Resupinate, in consequence of the early torsion of the pedicels.	Resupinate, in consequence of the early torsion of the pedicels.	At all times in their right position.	At all times in their right position.
	Asymmetrical	Asymmetrical	Asymmetrical	Symmetrical.
Calyx	Larger than the corolla, remarkably irregular.	Larger than the corolla, remarkably irregular.	Smaller than the corolla, slightly irregular.	Smaller than the corolla, slightly irregular.
	With a short and sometimes obsolete spur.	Without spur	Without spur	Without spur.
Calycine segments.	5	5	5	5.
	One superior small, two lateral narrow, two inferior wide, large, all equally free.	One superior small, two lateral narrow, two inferior wide, large, all equally free.	Hardly unequal; one superior, two lateral, two inferior, which last are connected into one.	Hardly unequal; one superior, two lateral, two inferior, which last are connected into one.
Petals	5	4	5	5.
	Unguiculate, alternate with the calycine segments.	Unguiculate, alternate with the calycine segments.	Unguiculate, alternate with the calycine segments.	Unguiculate, alternate with the calycine segments.
	Lower one abortive	Lower one wanting	Lower one a little smaller	Lower one a little smaller.
	Lateral and posterior ones converging and connected by the woolly margins of their claws.	Lateral and posterior ones converging and connected by the woolly margins of their claws.	All free	All free.

Disc	Incomplete, excentric, placed in the posterior side of the flower, between the petals and stamens.	Incomplete, excentric, placed in the posterior side of the flower, between the petals and stamens.	Incomplete, excentric, placed in the posterior side of the flower, between the petals and stamens.	Incomplete, excentric, placed in the posterior side of the flower, between the petals and stamens.
	Hippocrepiform	Hippocrepiform	Hippocrepiform	Hippocrepiform or annular.
Stamens	4, slightly didynamous	4, slightly didynamous	4, slightly didynamous	5.
	Alternate with the petals	Alternate with the petals	Alternate with the petals	Alternate with the petals.
	The bases of the two posterior slightly connected, the inferior wanting.	The bases of the two posterior slightly connected, the inferior wanting.	The bases of the two posterior slightly connected, the inferior wanting.	All perfect and monadelphous.
Anthers	Introrse, bilocular, opening by two vertical clefts, attached on the back, a little above their base.	Introrse, bilocular, opening by two vertical clefts, attached on the back, a little above their base.	Introrse, bilocular, opening by two vertical clefts, attached on the back, a little above their base.	Introrse, bilocular, opening by two vertical clefts, attached on the back, a little above their base.
Ovarium	4-celled (cells alternate with the stamens).	4-celled (cells alternate with the stamens).	4-celled (cells alternate with the stamens).	5-celled (cells alternate with the stamens).
Style	Subulate, bent backwards	Subulate, bent backwards	Subulate, bent backwards (thick)	Subulate, bent backwards (thick).
Stigma	4-toothed	4-toothed	4-lobed	5 lobed.
Ovules	4 (anatropous) in each cell	2 or 4 (anatropous) in each cell.	1 (anatropous) in each cell	1 (anatropous) in each cell.
	Attached above the middle of the internal angle.	Attached above the middle of the internal angle.	Attached at the base of the internal angle.	Attached at the base of the internal angle.
	Horizontal or ascending	Horizontal or ascending	Ascending	Ascending.
Fruit	Follicular capsule almost tetrapterous.	Follicular capsule almost tetrapterous.	Coriaceous, subglobose capsule.	Coriaceous, subglobose capsule.
	4-lobed at its apex	Equal and not lobed at both ends.	Not lobed	Not lobed.
	With a loculicide dehiscence	With a loculicide dehiscence	With a loculicide dehiscence	With a loculicide dehiscence.
Seeds	2 in each cell	2 or 4	Solitary	Solitary.
	Not arillate	Not arillate	With a fleshy cupular arillus	With a fleshy cupular arillus.
Testa	Crustaceous	Crustaceous	Crustaceous	Crustaceous.
Albumen	Copious, almost horny	Copious, almost horny	Copious, almost horny	Copious, almost horny.
Embryo	Straight in the axis of the albumen, with a clavate radicle longer than the plano-convex cotyledons.	Straight in the axis of the albumen, with a clavate radicle longer than the plano-convex cotyledons.	Straight in the axis of the albumen, with a clavate radicle longer than the plano-convex cotyledons.	Straight in the axis of the albumen, with a clavate radicle longer than the plano-convex cotyledons.

Melianthus being usually considered as an anomalous form of *Zygophylleæ*, the question presents itself, to what natural class this last order is to be referred? Is it also to be admitted simply as a tribe of *Rutaceæ* (as defined by the Jussieus), or shall we follow Mr. Robert Brown in considering it as an independent order? The author not only declares in favour of the latter opinion, but expresses his belief that while, on the one hand, *Diosmeæ* (including *Ruteæ*, *Diosmeæ* proper, *Zanthoxyleæ* and *Aurantiaceæ*), together with *Simarubeæ* and *Meliaceæ*, constitute a natural class, so, on the other hand, *Zygophylleæ*, *Oxalideæ*, *Connaraceæ*, *Leguminosæ* and *Moringeæ* are closely connected into one group, not only by their general structure and *facies*, but by the common tendency of their compound leaves to periodical sleep, or occasionally to movement under an irritating influence, a physiological phænomenon connected with the structural fact of the articulation of the foliole with the petiole on which it moves.

Neither of the two natural classes just mentioned admits, in the opinion of the author, the new order of *Melianthеæ*.

The pinnate leaves, irregular flowers, excentric and incomplete disc placed outside of the stamens, the quaternary proportion * of these organs in contrast with the quinary division of the calyx, the occasional cohesion of two of the sepals, the close analogy of the follicular capsule of *Diplerisma* with that of *Cardiospermum*, and of the coriaceous fruit and arillate seeds of *Bersameæ* with the corresponding parts in *Paullinia*, and the fact of a species of *Natalia* being justly named *Paullinioides*, are the points by which the close affinity of *Meliantheæ* with *Sapindaceæ* are traced out. Thus by the knowledge of very recent materials (*Bersama* and *Natalia* being both but lately discovered) are confirmed the views which Adanson expressed upon the affinities of *Melianthus*, when, in his otherwise rather heterogeneous family of *Gerania*, he placed that singular genus between *Cardiospermum* and *Geranium*.

After some other general considerations, the author concludes with a review of the geographical distribution of *Meliantheæ*, the most striking fact mentioned being the occurrence of *Melianthus Himalayanus*, Wall., in the mountains of northern India, while its only congener, the well-known *Melianthus major*, L., does not exceed the limits of the flora of the Cape of Good Hope.

BOTANICAL SOCIETY OF EDINBURGH.

April 13, 1848.—Rev. Dr. Fleming, President, in the Chair.

1. "Notes of Shropshire Rubi," by the Rev. Wm. A. Leighton, B.A.

The species noticed in this communication, which is the first of a series, were *Rubus idæus*, *suberectus*, *fissus* (Fl. Shrop.), *plicatus* (W. et N.), *affinis* (W. et N.), and *nitidus* (W. et N.).

2. "On the Reproduction of Cryptogamic Plants," by the late

* *Bersama* must here be excepted, because of its five stamens.

Wm. Stark Dougall, Esq.; part 3rd, on the Reproduction of *Lycopodiaceæ, Marsileaceæ* and *Filices.*

In this portion of the paper, the author first considers *Lycopodiaceæ*, in which he points out two sets of capsules differing in their respective contents. In *Marsileaceæ*, also, he notices two forms of reproductive bodies, and concludes by stating that there is evidence in favour of sexual reproduction in the Lycopodial alliance, the *Lycopodiaceæ* being hermaphrodite, and *Marsileaceæ* monœcious. In *Filices*, especially *Polypodiaceæ*, he points out the existence of antheridia associated with filiform bodies, and of thecæ or spore-cases. In some ferns phytozoa have been detected. He concludes by a general review of the whole subject, and expresses an opinion in favour of the view that the union of two cellular bodies is required in order to form the perfect spore.

3. Mr. Hamlin Lee exhibited a simple mode of constructing aquatic cells for microscopical objects, by splitting across very flat watch-glasses and cementing them to a piece of glass so as to leave cavities for holding fluid.

Dr. Balfour noticed a few plants gathered at Arniston on the 25th of March last. Eighteen phanerogamous plants were observed in flower, including *Pulmonaria officinalis, Lathræa squamaria, Galanthus nivalis,* &c.

MISCELLANEOUS.

On some Microscopic Organisms found in the Stomach of a Peruvian Freshwater Fish. By Prof. Ehrenberg.

M. Valenciennes having discovered in the stomach and in the intestinal canal of *Lebiasina bimaculata*, a new genus of fish belonging to the family *Erythrini*, a number of Infusoria, forwarded them to Prof. Ehrenberg to determine the species. The stomach and intestinal canal were filled as far as Bauhin's ventricle with a blackish or reddish mud. The river in which this small fish lives is said to flow from the Titicaca lake, and we thus obtain, by means of the microscopic organisms contained in the stomach of this fish, the first glance into the forms of the interior of Peru.

From Ehrenberg's examination of several hundred kinds of fish, it resulted that they very rarely and only accidentally contain isolated specimens of infusoria taken up with their food in the contents of their stomach and intestinal canal, a circumstance of importance in deciding the question respecting the origin of guano. This is generally regarded as the product of the numerous piscivorous birds inhabiting these localities. As these birds do not take in either water or mud purposely in any quantity, the infusoria could only have been contained in the fish upon which they had fed*. This difficulty was pointed out in a former communication, and the main part in the formation of the guano ascribed to the vermiferous shore birds.

* This conclusion appears to us unnecessary; it is far more probable that during the process of formation of these valuable deposits, spray containing multitudes of the infusoria may have been carried on to it.—W. F.

This Peruvian fish however is interesting from its showing that there exist fishes there which live principally upon infusorial mud. Whether this occurs upon an extensive scale and also in the case of the salt-water fish of that country must be left to further inquiry.

In the small sample of the contents of the stomach forwarded, the following species have been determined :—

POLYGASTRICA 27.

Amphora gracilis.	Navicula lineolata.
Cocconeïs fasciata.	Scalprum.
Placentula.	Pinnularia affinis.
Cocconema Leptoceros.	borealis.
Lunula.	peregrina.
Coscinodiscus radiolatus ?	viridis.
Discoplea ? (Gallionella ?).	Podosphenia Pupula.
Eunotia gibba.	Synedra acuta.
Fragilaria acuta.	constricta ?
rhabdosoma.	Entomon.
Glœonema paradoxum ?	Sphenosira Catena.
Gomphonema gracile.	Stauroneïs linearis.
Augur.	Stauroptera Monogramma.
Himantidium Arcus.	

PHYTOLITHARIA 4.

Lithostylidium Clepsammidium.	Lithostylidium rude.
Rajula.	Trabecula.

It is evident from this list that the river water in which the fish was taken contains an admixture of sea animalcules (*Coscinodiscus*), and consequently is situated either within the tidal reach of the ocean, or, as only fragments of the marine form were noticed, flows over tertiary biolithic deposits. *Cocconeïs fasciata* is likewise a known form from the coast of Peru.

Synedra Entomon, known hitherto only from Chili, is remarkable from its occurrence in the dust of the trade-winds. *Synedra ? constricta* is a smooth form characteristic from its two extremities being drawn out into two long-pointed needles. *Stauroneïs linearis* and *Sphenosira Catena* are known American forms from Chili and Mexico. *Stauroptera Monogramma* is a ribbed form resembling the smooth *Stauroneïs Monogramma* from Surinam, which is again similar to but not identical with *Achnanthes ventricosa.*—*Report of the Berlin Academy,* Jan. 1848.

Discovery of the Maxillary Organs of the Iguanodon.

Dr. Mantell's researches have at length been rewarded by the discovery of portions of both the upper and lower jaw of the Iguanodon, nearly thirty years after his first announcement of the form and structure of the teeth of that colossal herbivorous reptile.

The form of the maxillary organs of the Iguanodon is most extraordinary, and entirely differs from anything previously known in the class of reptiles. The configuration of the lower jaw approaches

nearest to that of the large extinct Edentata, the Mylodons; but the structure of the symphysial portion is unlike that of any other animal. Dr. Mantell will shortly present a memoir on this most interesting discovery to the Royal Society, in whose Transactions his first memoir on the Teeth of the Iguanodon was published in 1825. The lower jaw, containing teeth, was discovered by Captain Bickenden, the upper by Dr. Mantell: both are from the same locality in Tilgate Forest.

Description of a new British Mould. By George Johnston, M.D. &c.

I am willing to believe, with my Lord Bacon, that Mould "is something between putrescence and a plant." It settles a much-mooted point as well as any other theory has yet done. Organic substance, in a state of decay, is Mould's fruitful matrix,—life from death,—the ever-yearning change from a worse to a better condition; for life, even in this its lowest state, is better certainly than sad corruption. And how beautiful are many Moulds, when, with the microscope, we discover Nature's handicraft in them to the eye of sense! We can scarcely but believe that they have a sort of enjoyment in their life, and in the evolution of their symmetrical figures. One sort is now vigorous and abundant on some plants in my little "Green-house," where it is as noxious as the Green-fly, or Aphis; and it is rather singular that the species has not been yet recorded as a British production. I have the high authority of the Rev. M. J. Berkeley for this fact, who informs me that our Mould is the *Botrytis umbellata** of DeCandolle.

Botrytis umbellata. On a flat and smooth leaf, the decumbent filaments of this Mould form a cobweb-like mycelium, but on leaves with an uneven surface, and on the stalks of herbs, the mycelium is so filamentous and thin as to be scarcely perceptible; while the erect filaments are so numerous as to render the surface downy or hirsute. The decumbent filaments are also slenderer than the others, but there is no difference in their structure; they are smooth hyaline membranous tubes jointed at distant intervals, the joints alternately swollen and constricted, but not regularly so, and when moistened with water, the whole tube becomes swollen, tense, and cylindrical. The erect filaments are two lines in height, of a gray or cinereous colour, with a hoary sporuliferous head; they are sparingly and irregularly branched, and at the top four or five short divergent branchlets form a sort of imperfect umbel, collecting, as it were, the sporules into a round heap or summit. The main branches are either divergent or dichotomous; and many of the filaments are quite simple. The sporules are ovate or elliptical, often marked with a septum, sometimes transversely, and in others in a longitudinal direction; and this septum disappears when the sporules are moistened. The number of sporules is incalculable; they fall from the head and are found adherent to every fibre of the plant; and when this is shaken, they fly abroad in a little cloud.

* Lam. et DeCand. Fl. Franç. ii. 71. Duby, Bot. Gall. ii. 921.

My friend Mr. Bowerbank examined this Mould with the microscope. When highly magnified, many of the main filaments exhibited slight protuberances, which were supposed to be incipient branches; these were sometimes opposed to each other, and sometimes they were not quite in opposition. The sporules varied considerably in size, and were ovate or elliptical. Placed in water between glasses, after a lapse of two days it was found that most of the sporules had germinated, each emitting a single filament, which was sparingly and irregularly branched, and contained some very minute granules.—*From the Transactions of the Berwickshire Naturalists' Club*, vol. ii. p. 213.

METEOROLOGICAL OBSERVATIONS FOR APRIL 1848.

Chiswick.—April 1. Foggy: very fine: clear. 2. Foggy in the morning: very fine. 3, 4. Slight fog: fine. 5. Fine. 6. Overcast: very fine. 7. Cloudy: rain at night. 8, 9. Rain. 10. Fine: rain at night. 11. Cloudy: rain. 12. Showery. 13. Overcast: heavy rain at night. 14. Clear and cold. 15. Foggy: rain. 16. Hazy and damp: cloudy: rain. 17. Showery. 18. Rain. 19. Cloudy: fine. 20. Fine: rain. 21. Drizzly: overcast: rain at night. 22. Rain: drizzly: partially overcast. 23. Fine: cloudy: slight rain. 24. Overcast: drizzly. 25. Densely clouded. 26. Fine. 27. Clear: shower: clear. 28. Cold rain: overcast: clear. 29. Overcast: fine. 30. Fine throughout.

Mean temperature of the month	47°·33
Mean temperature of April 1847	44 ·28
Mean temperature of April for the last twenty years	47 ·06
Average amount of rain in April	1·47 inch.

Boston.—April 1. Foggy. 2. Fine: thunder and lightning P.M. 3, 4. Fine. 5. Cloudy: rain P.M. 6. Fine: rain early A.M. 7. Fine. 8. Rain: rain A.M. and P.M. 9. Cloudy: rain A.M. 10. Cloudy: rain P.M. 11. Fine. 12. Cloudy: rain A.M. and P.M. 13. Rain: rain A.M. 14. Fine. 15. Cloudy. 16. Cloudy: rain P.M. 17. Cloudy: rain early A.M. 18. Cloudy: rain P.M. 19, 20. Fine: rain P.M. 21. Cloudy. 22. Cloudy: rain early A.M. 23. Cloudy: brisk wind: rain P.M. 24. Rain: rain A.M. 25. Rain: rain early A.M.: rain P.M. 26. Cloudy: hail and rain A.M. 27. Fine. 28. Cloudy. 29, 30. Fine.

Applegarth Manse, Dumfries-shire.—April 1. Fine spring day. 2. Fine spring day: one slight shower. 3. Fine spring day: rain P.M. 4. Fair, but cloudy. 5. Fair A.M.: rain P.M. 6. Fair A.M.: rain: hail. 7. Rain: frost A.M. 8. Showers: snow preceding night. 9. Fair: cloudy P.M. 10, 11. Frost A.M. 12. Cloudy: cleared. 13. Frost A.M. 14. Frost: one shower. 15. Frost: very cold. 16. Cloudy and threatening. 17. Rain early A.M. 18. Slight rain early. 19. Fair and fine: thunder. 20. Fine: showers. 21. Rain early A.M. 22. Slight shower: rain P.M. 23. Fair and droughty. 24. Fair: rain P.M. 25. Showery. 26. Slight hail. 27. Frost, keen: rain P.M. 28. Hail: frequent showers. 29. Hail: frost. 30. Hard frost.

Mean temperature of the month	43°·2
Mean temperature of April 1847	43 ·4
Mean temperature of April for twenty-five years	44 ·2
Mean rain in April for twenty years	1·76 inch.

Sandwick Manse, Orkney.—April 1. Bright: cloudy. 2. Bright: drops. 3. Damp: drops. 4. Bright: showers. 5. Showers: aurora. 6. Sleet-showers: showers: sleet. 7. Clear: frost: aurora. 8. Clear: frost: snow-showers. 9. Snow-showers: clear: frost. 10—13. Clear. 14. Cloudy. 15. Bright: cloudy. 16. Bright: cloudy: drops. 17, 18. Damp. 19. Cloudy. 20. Damp. 21. Cloudy. 22. Clear: cloudy. 23, 24. Damp. 25. Cloudy: drops. 26. Snow-showers: clear. 27. Bright: cloudy. 28. Hail-showers. 29. Sleet-showers: hail-showers: aurora. 30. Bright: hail-showers: aurora.

Days of Month. 1848. April.	Barometer. Chiswick. Max.	Barometer. Chiswick. Min.	Barometer. Boston. 8½ a.m.	Barometer. Dumfries-shire. 9 a.m.	Barometer. Dumfries-shire. 9 p.m.	Barometer. Orkney, Sandwick. 9½ a.m.	Barometer. Orkney, Sandwick. 8½ p.m.	Thermometer. Chiswick. Max.	Thermometer. Chiswick. Min.	Thermometer. Boston. 8½ a.m.	Thermometer. Dumfries-shire. Max.	Thermometer. Dumfries-shire. Min.	Thermometer. Orkney, Sandwick. 9½ a.m.	Thermometer. Orkney, Sandwick. 8½ p.m.	Wind. Chiswick. 1 p.m.	Wind. Boston.	Wind. Dumfries-shire.	Wind. Orkney, Sandwick.	Rain. Chiswick.	Rain. Boston.	Rain. Dumfries-shire.	Rain. Orkney, Sandwick.
1.	30·024	30·002	29·64	29·90	29·90	29·77	29·85	72	38	51	58	35	50½	49	ne.	calm	sw.	calm	......	......	......	·05
2.	29·984	29·881	29·56	29·85	29·80	29·81	29·84	75	40	58	60	34	52	45	e.	calm	s.	w.	......	......	......	......
● 3.	29·991	29·948	29·54	29·85	29·83	29·83	29·69	78	36	57	...	...	50	46½	s.	nnw.	s.	w.	......	......	......	......
4.	30·033	30·015	29·55	29·88	29·80	29·62	29·52	75	41	57	...	...	46½	41½	w.	w.	sw.	wsw.	......	......	......	·04
5.	29·989	29·736	29·47	29·74	29·59	29·47	29·53	61	40	53	...	...	42½	41	w.	w.	w.	nw.	·01	......	......	·20
6.	29·653	29·633	29·27	29·60	29·62	29·72	29·70	53	31	46	...	...	40½	36½	ne.	n.	n.	nw.	......	·16	......	·10
7.	29·591	29·440	29·24	29·56	29·40	29·59	29·70	47	36	46	...	...	37	35	ne.	n.	e.	calm	·04	......	......	·15
8.	29·460	29·334	29·08	29·50	29·58	29·79	29·84	43	38	40	40	32	41	36	ne.	e.	e.	nne.	·04	·04	0·45	·06
9.	29·515	29·539	29·32	29·61	29·46	29·71	29·58	53	34	42	45½	30	37	33½	ne.	ne.	e.	calm	·14	·23	......	......
☽ 10.	29·483	29·328	29·13	29·27	29·29	29·50	29·54	53	30	39·5	42	32	41	36	s.	ne.	ese.	calm	·27	......	......	......
11.	29·759	29·453	29·28	29·53	29·48	29·57	29·54	59	42	42	39	29	41	36	nw.	n.	sw.	calm	·12	·32	......	......
12.	29·540	29·432	29·00	29·25	29·33	29·41	29·47	60	43	50	40	34	41	38½	sw.	wsw.	ne.	w.	·16	·25	......	......
13.	29·675	29·540	29·20	29·52	29·55	29·53	29·57	57	35	47	45	31½	38	40	w.	nw.	nw.	w.	·45	·40	......	......
14.	30·069	29·853	29·43	29·72	29·91	29·77	30·03	55	29	42	50	31	40½	38	nw.	nnw.	w.n.e.	n.	......	·05	......	......
15.	29·994	29·881	29·60	29·81	29·73	29·94	29·87	55	42	44·5	51½	33	42½	40	sw.	se.	e.	se.	·28	......	......	......
16.	29·980	29·733	29·50	29·75	29·47	29·76	29·58	58	46	48	52	38½	47	44	s.	sse.	e.	se.	·29	......	0·05	......
17.	29·693	29·619	29·22	29·35	29·39	29·44	29·46	61	32	52	55	45	47	44	sw.	calm	sw.	se.	·11	·40	......	·17
○ 18.	29·695	29·308	29·95	29·39	29·14	29·56	29·58	57	35	48	57	42½	44	43	s.	calm	se.–e.	ese.	·31	......	......	......
19.	29·334	29·292	28·94	29·13	29·21	29·58	29·57	61	36	53	55½	45	45	43	s.	s.	ne.	ne.	......	·15	......	......
20.	29·389	29·304	29·00	29·39	29·48	29·62	29·79	59	46	55	58	42	44	44½	ne.	ene.	ne.	e.	·39	·05	......	·07
21.	29·507	29·442	29·10	29·50	29·60	29·81	29·89	54	46	51·5	55½	43½	50½	47	nw.	calm	nne.	.e.	·09	·31	......	·07
22.	29·583	29·447	29·11	29·61	29·68	29·94	30·00	54	44	50	54	44	51	45	nw.	e.	nne.	ene.	·02	·04	......	......
23.	29·679	29·652	29·35	29·75	29·77	29·97	30·03	60	44	52	51	41½	43½	43	ne.	ne.	ne.	ne.	·03	......	0·32	......
24.	29·823	29·619	29·35	29·82	29·85	30·04	30·01	50	39	45·5	54	41½	45½	43	ne.	ene.	ne.	n.	·08	·20	......	......
25.	29·862	29·827	29·50	29·81	29·80	29·98	29·98	50	29	41	53	43	43½	39½	n.	e.	ne.	n.	·01	·10	......	......
☾ 26.	29·923	29·761	29·48	29·83	29·79	29·89	29·81	54	26	45	51	35½	41½	38	ne.	nw.	n.	nne.	......	·01	......	·07
27.	29·899	29·793	29·54	29·70	29·50	29·67	29·63	57	30	47	52	29½	41	39	sw.	calm	n.-sw.	calm	·10	·07	......	......
28.	29·844	29·694	29·30	29·40	29·60	29·51	29·53	56	28	46	48	34	38	39	sw.	nw.	wnw.	wnw.	·12	......	......	·06
29.	30·034	29·989	29·56	29·75	29·86	29·56	29·74	58	27	48	48½	32	41	39	sw.	n.	nw.	wnw.	......	......	......	·11
30.	30·171	30·001	29·73	29·95	30·00	29·94	30·06	63	29	51	53	28	41	41½	n.	n.	nnw.	w.	......	......	0·45	......
Mean.	29·772	29·649	29·36	29·624	29·613	29·710	29·731	58·26	36·40	46·7	50·7	36·2	43·48	40·83					3·06	2·78	1·27	1·15

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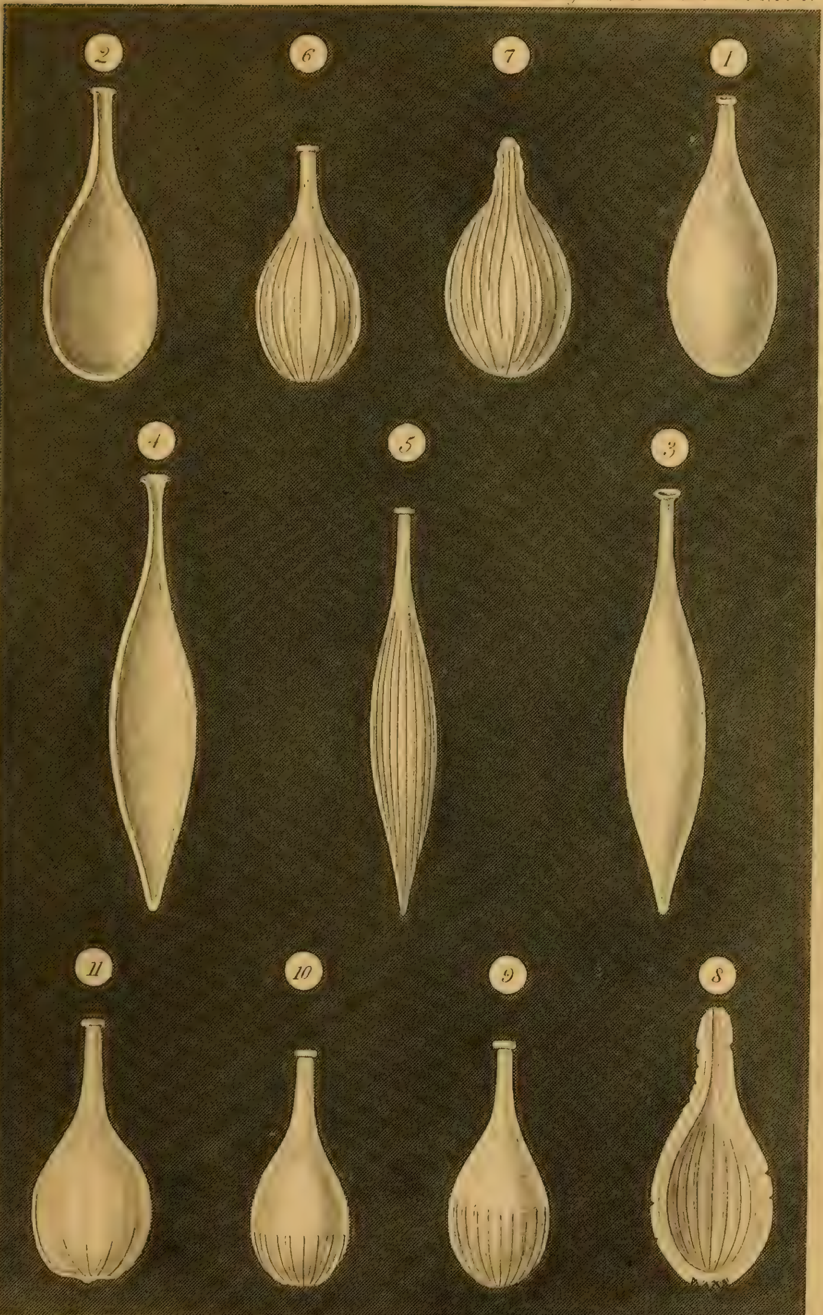

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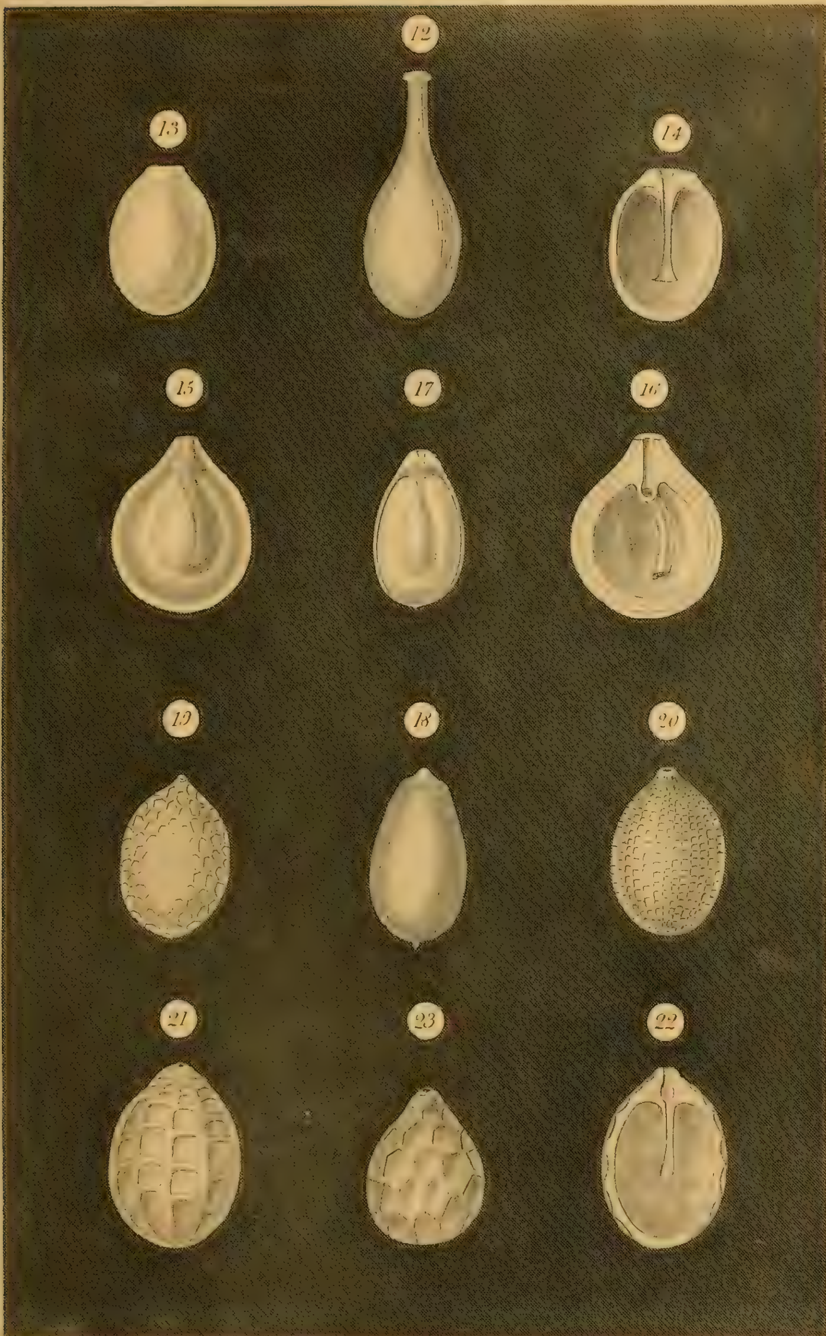

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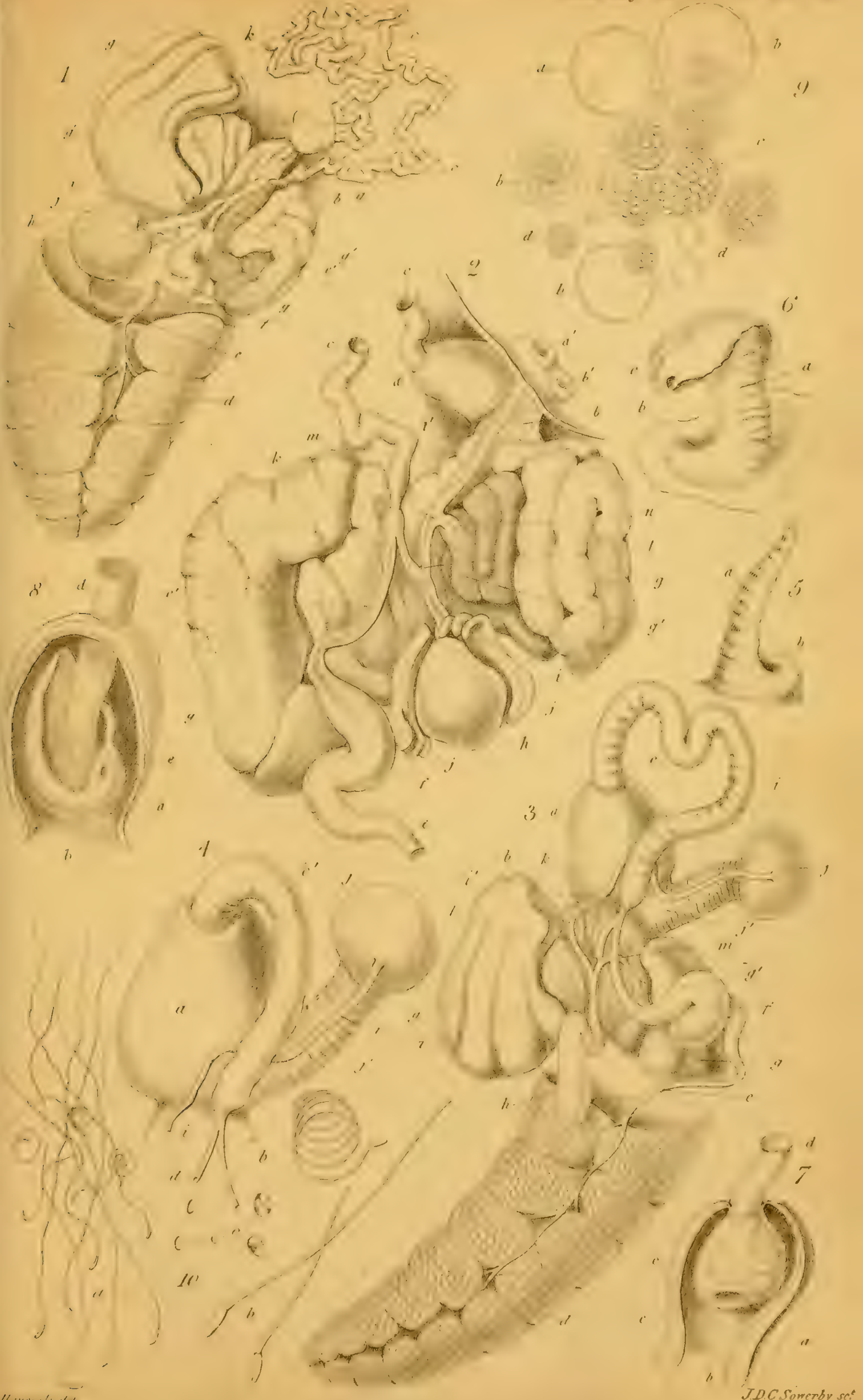

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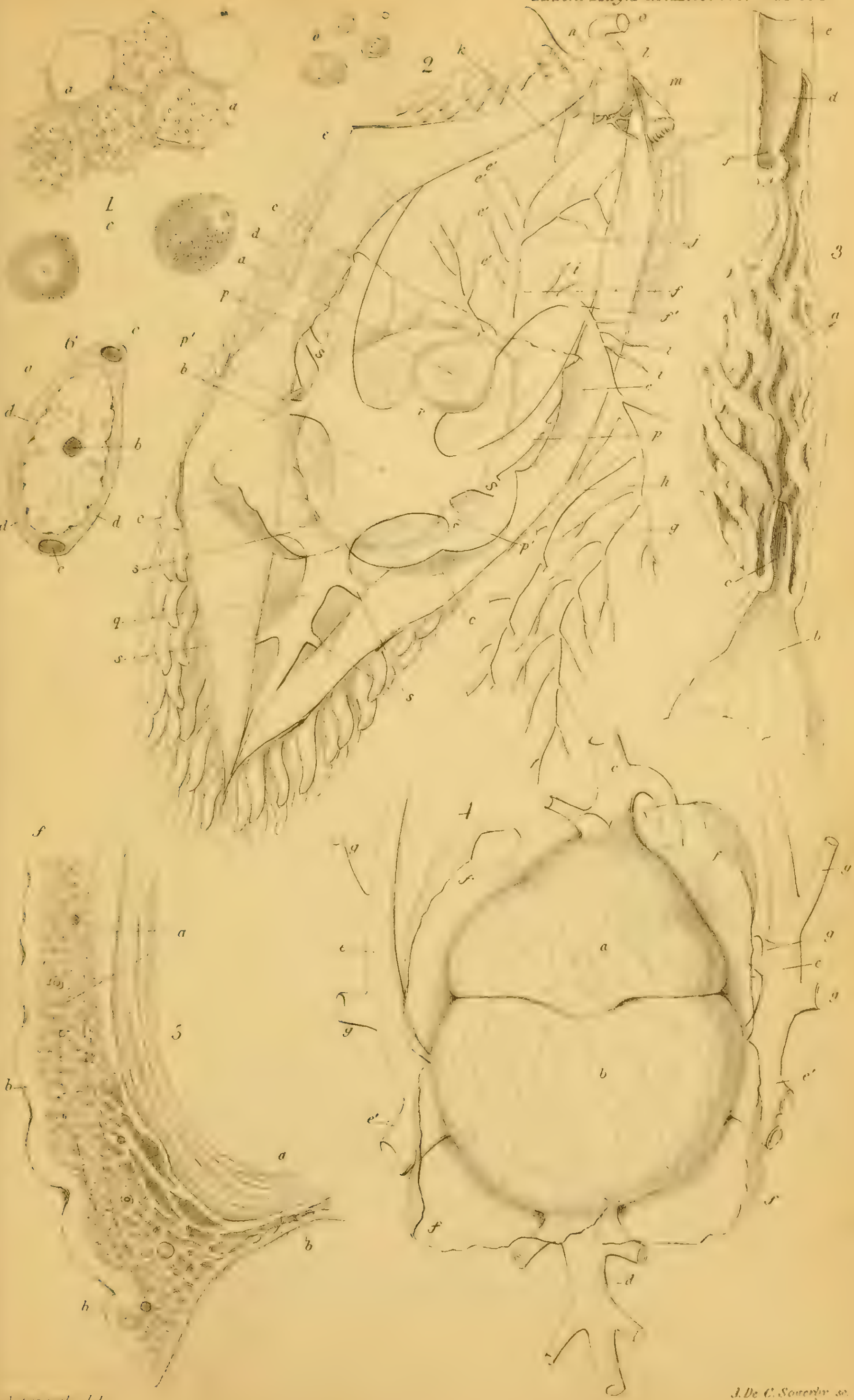

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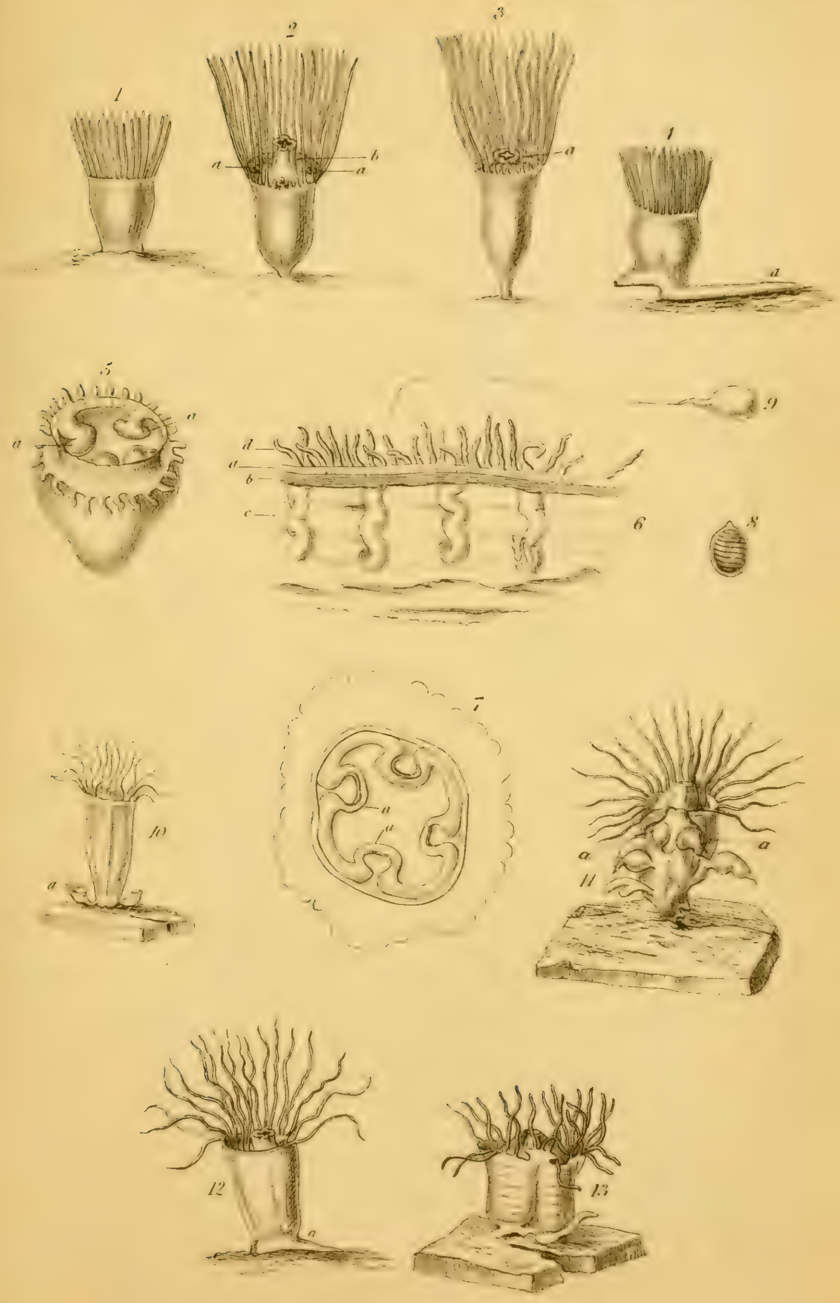

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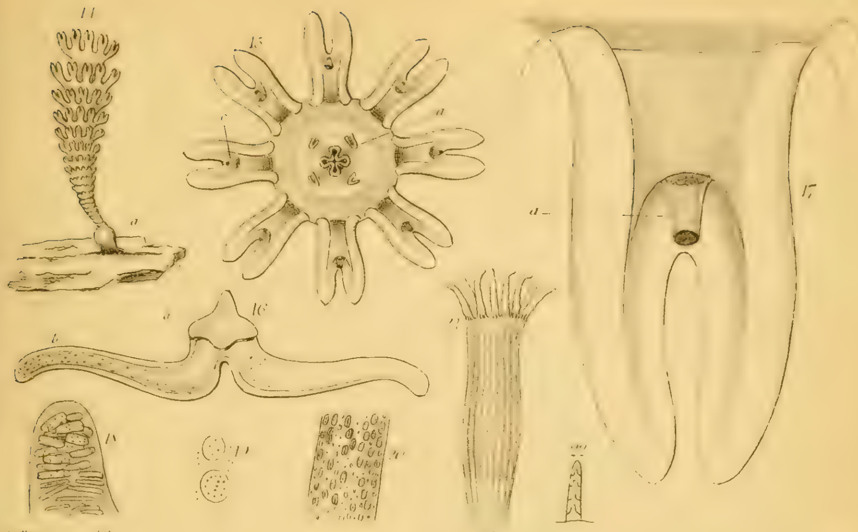

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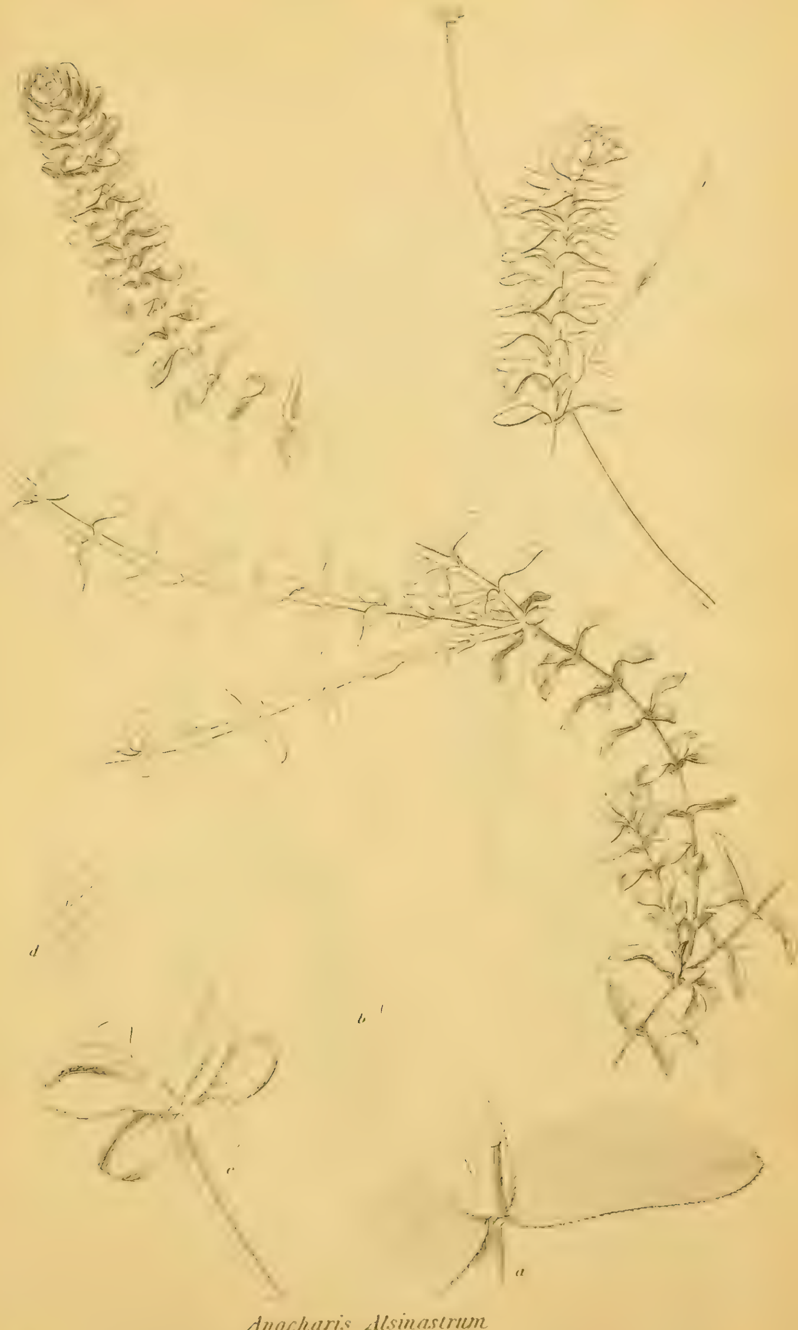

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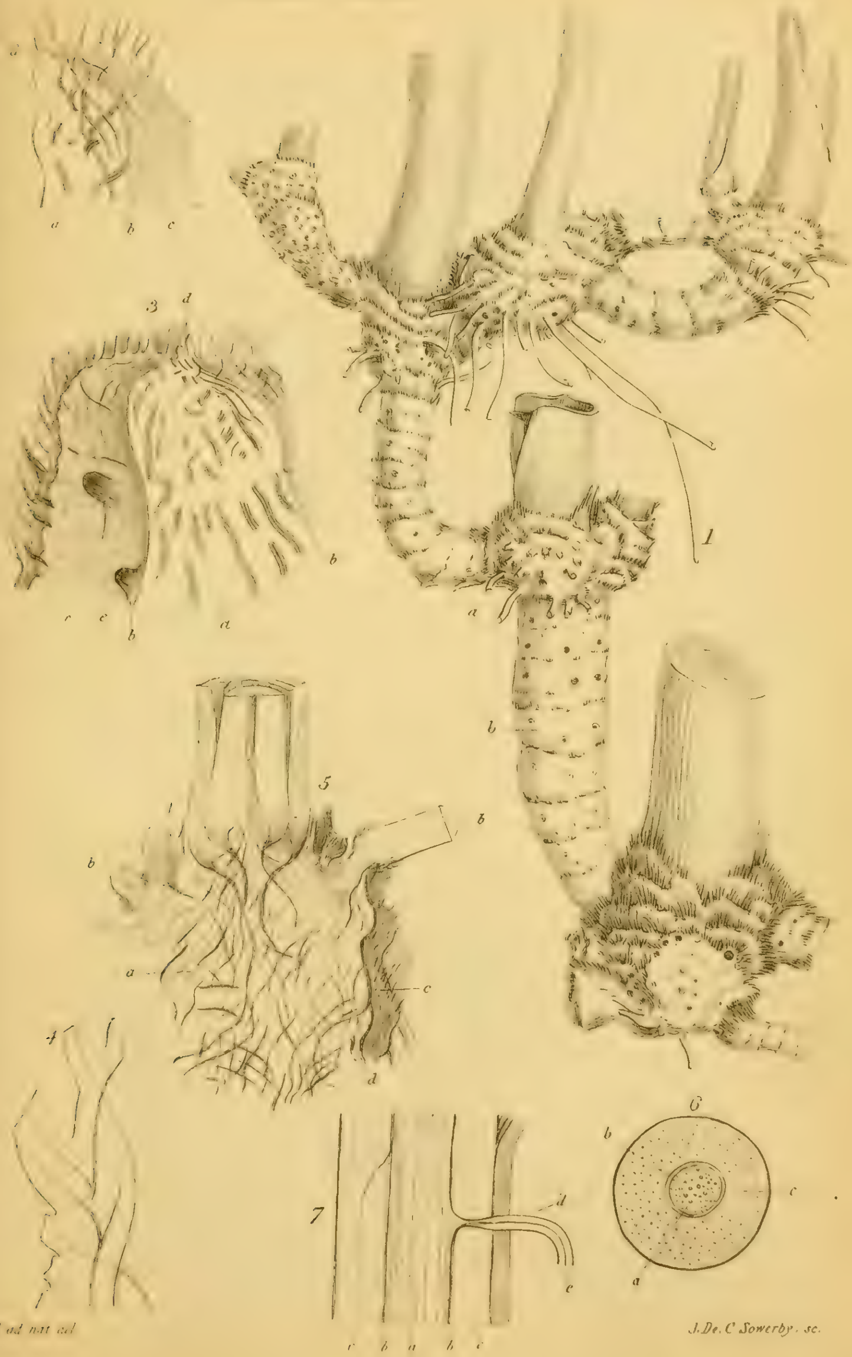

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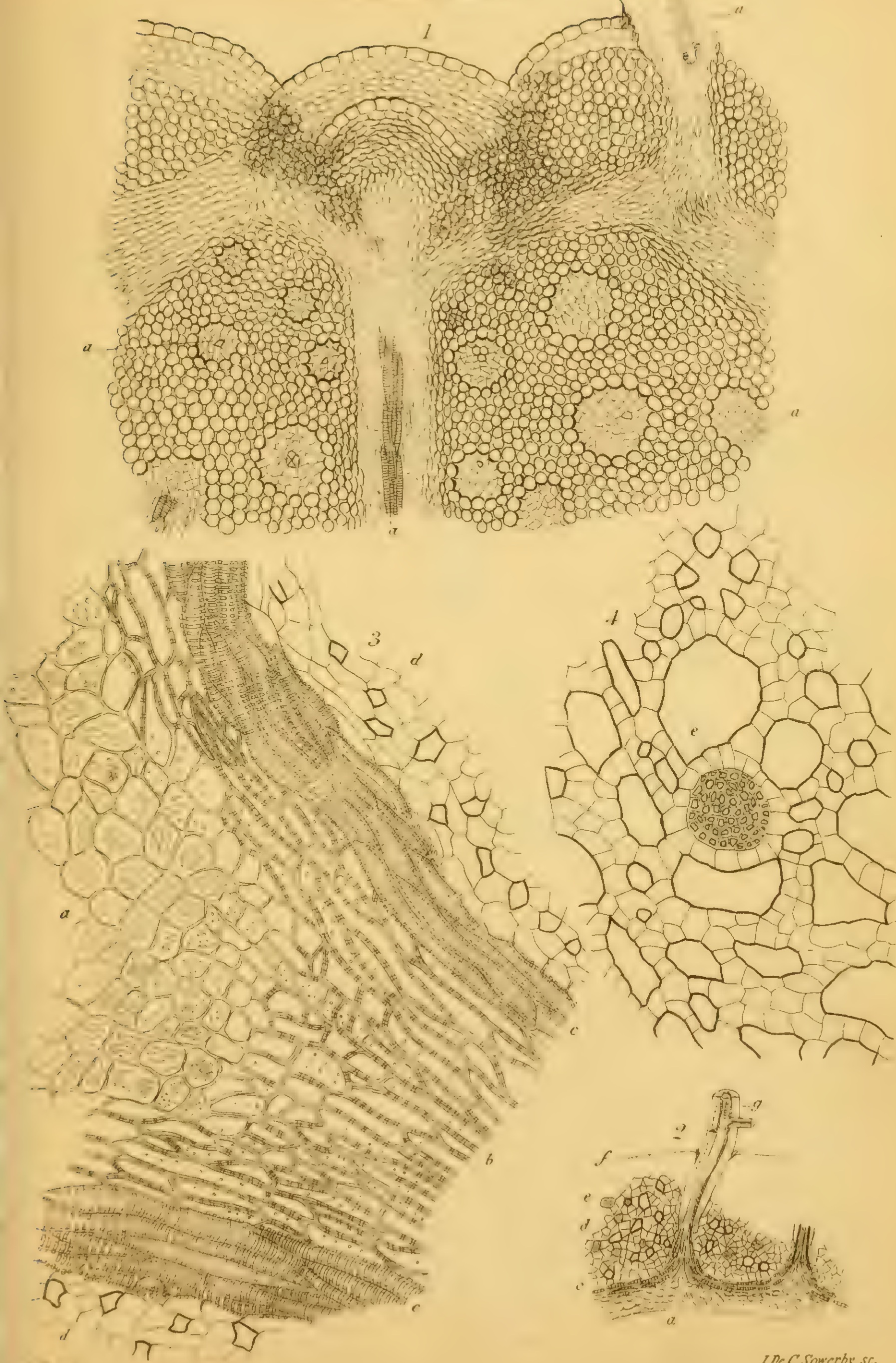

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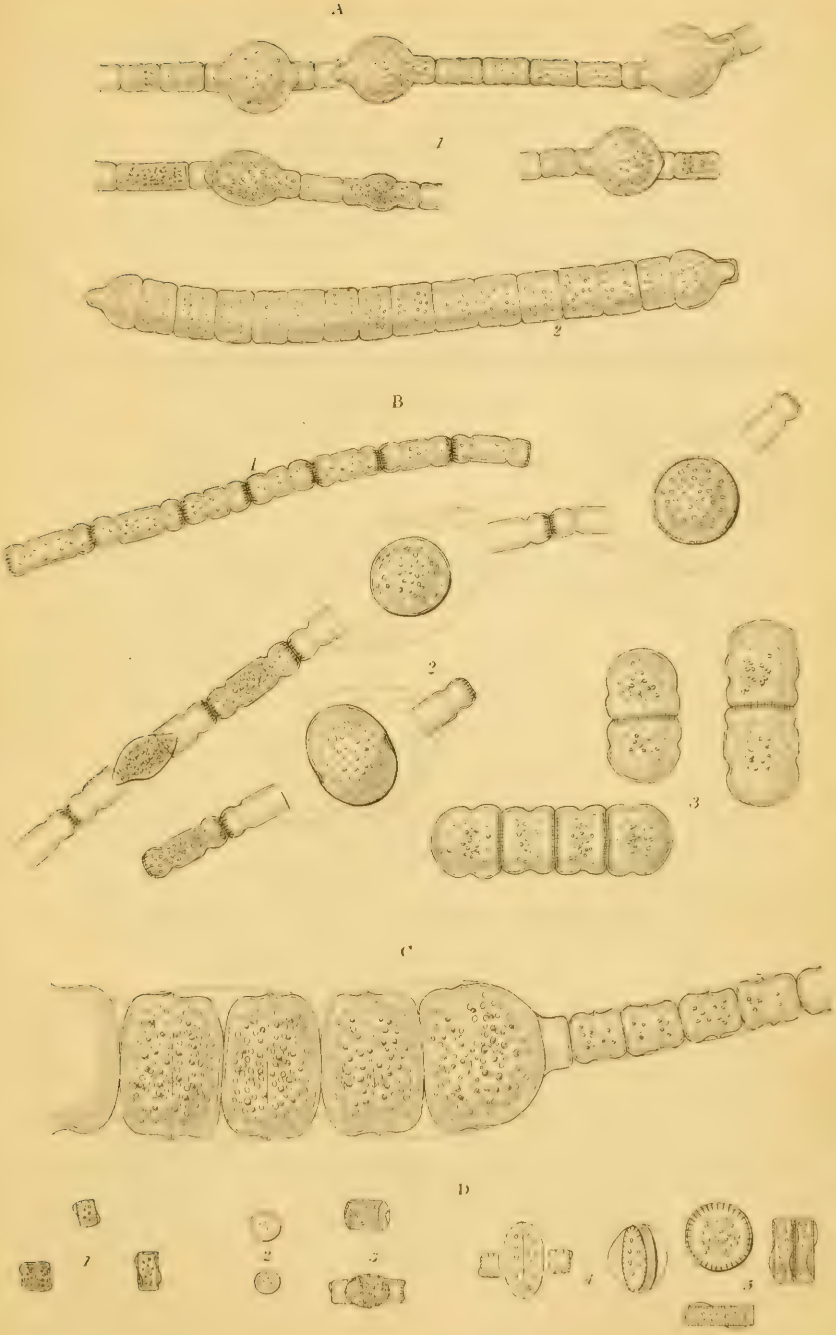

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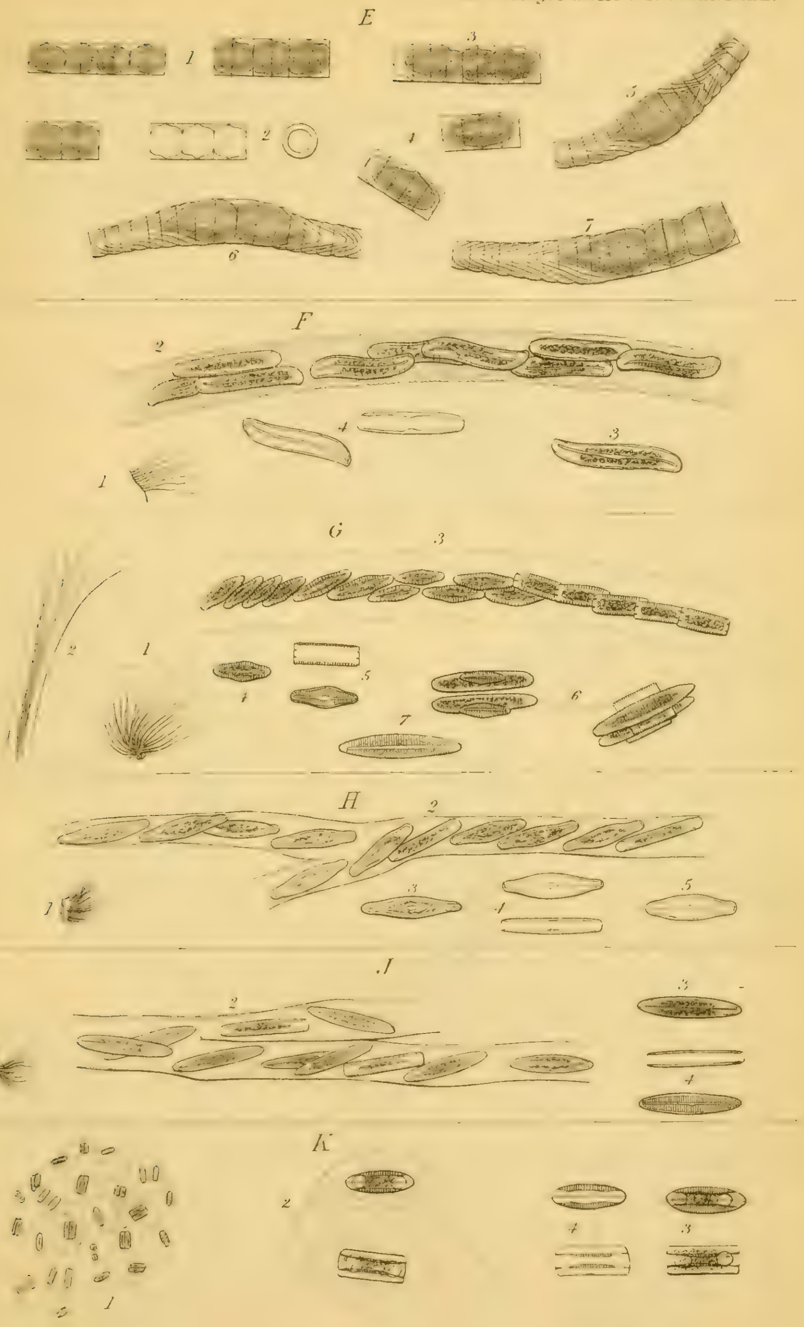

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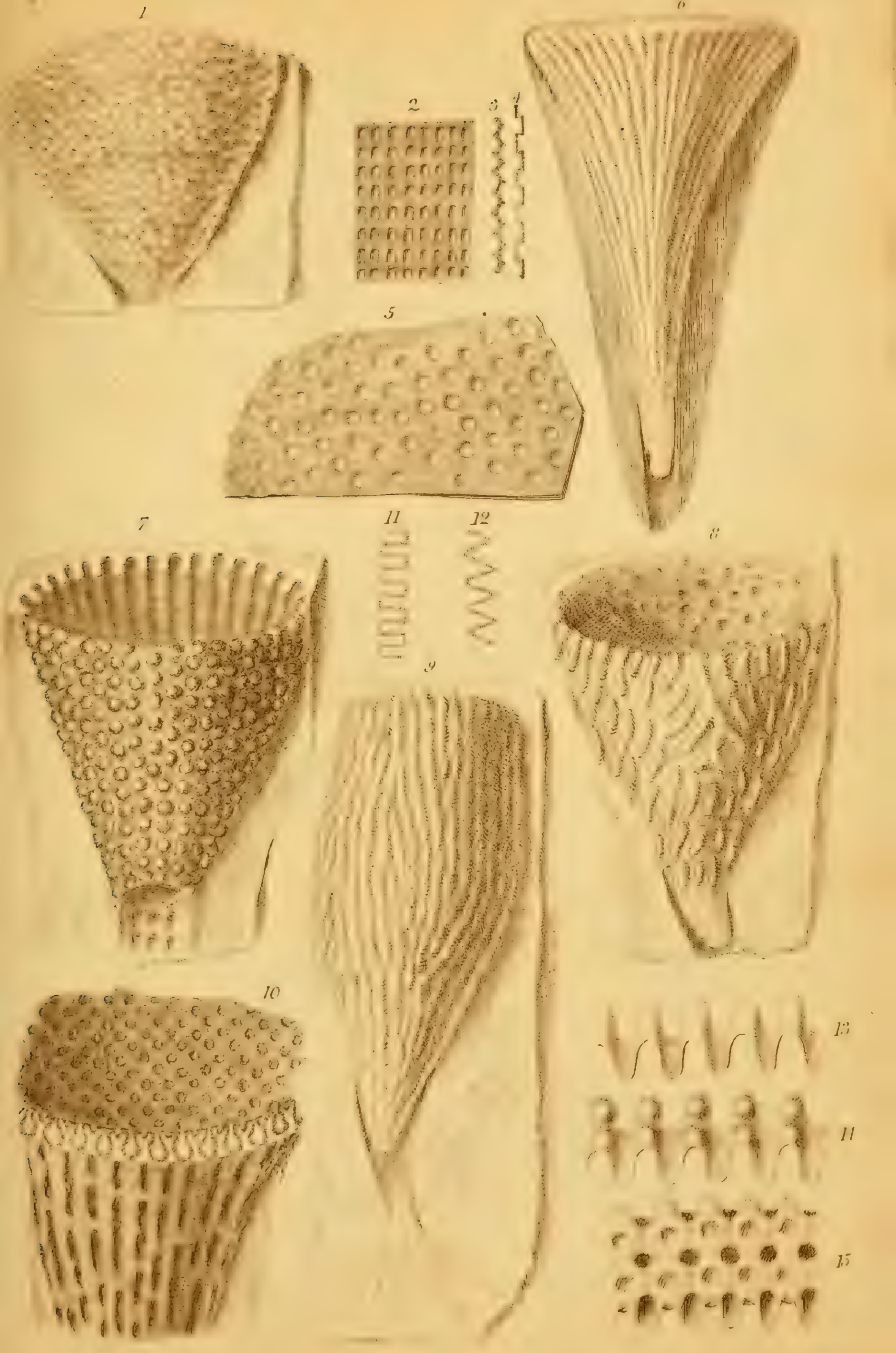

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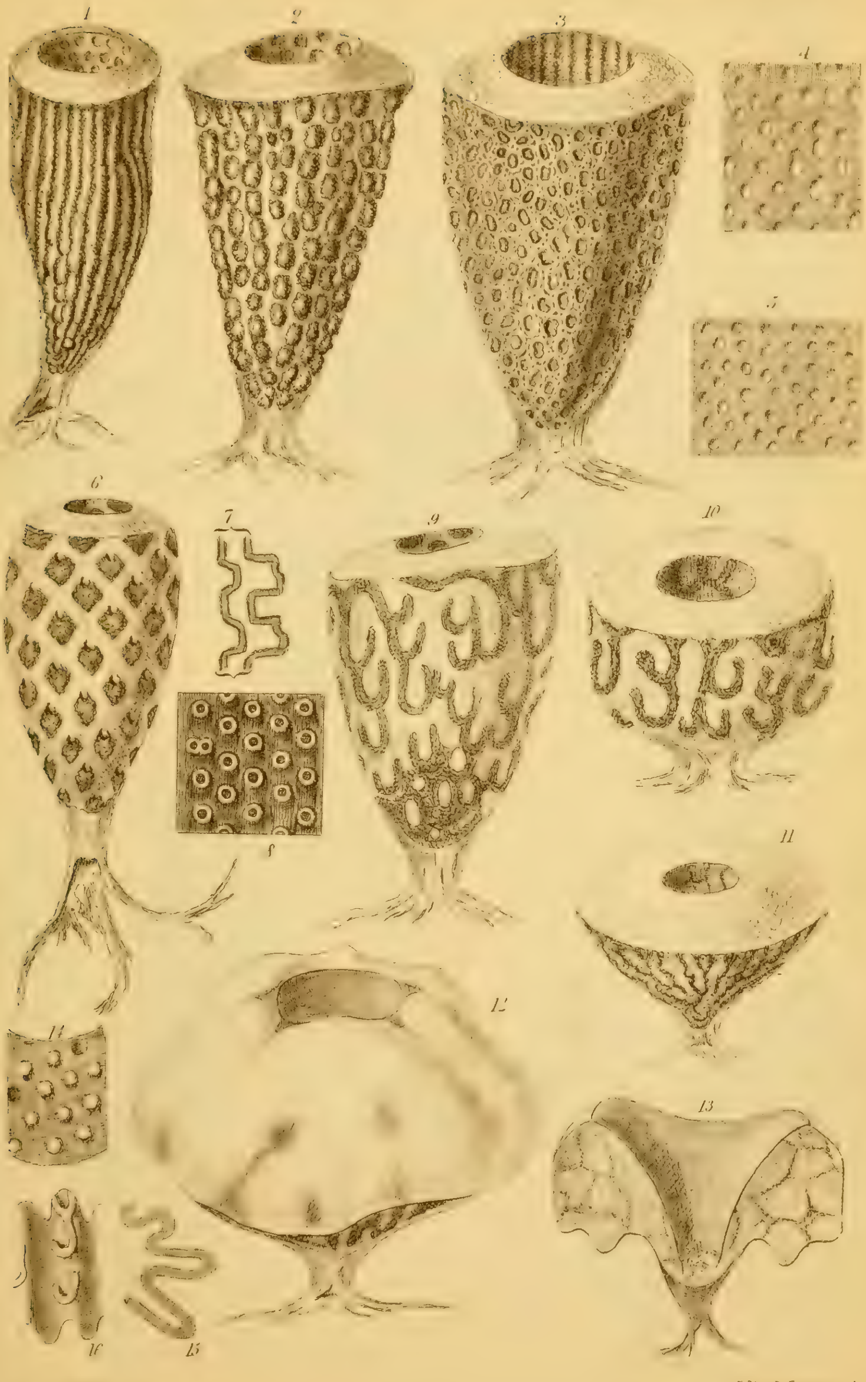

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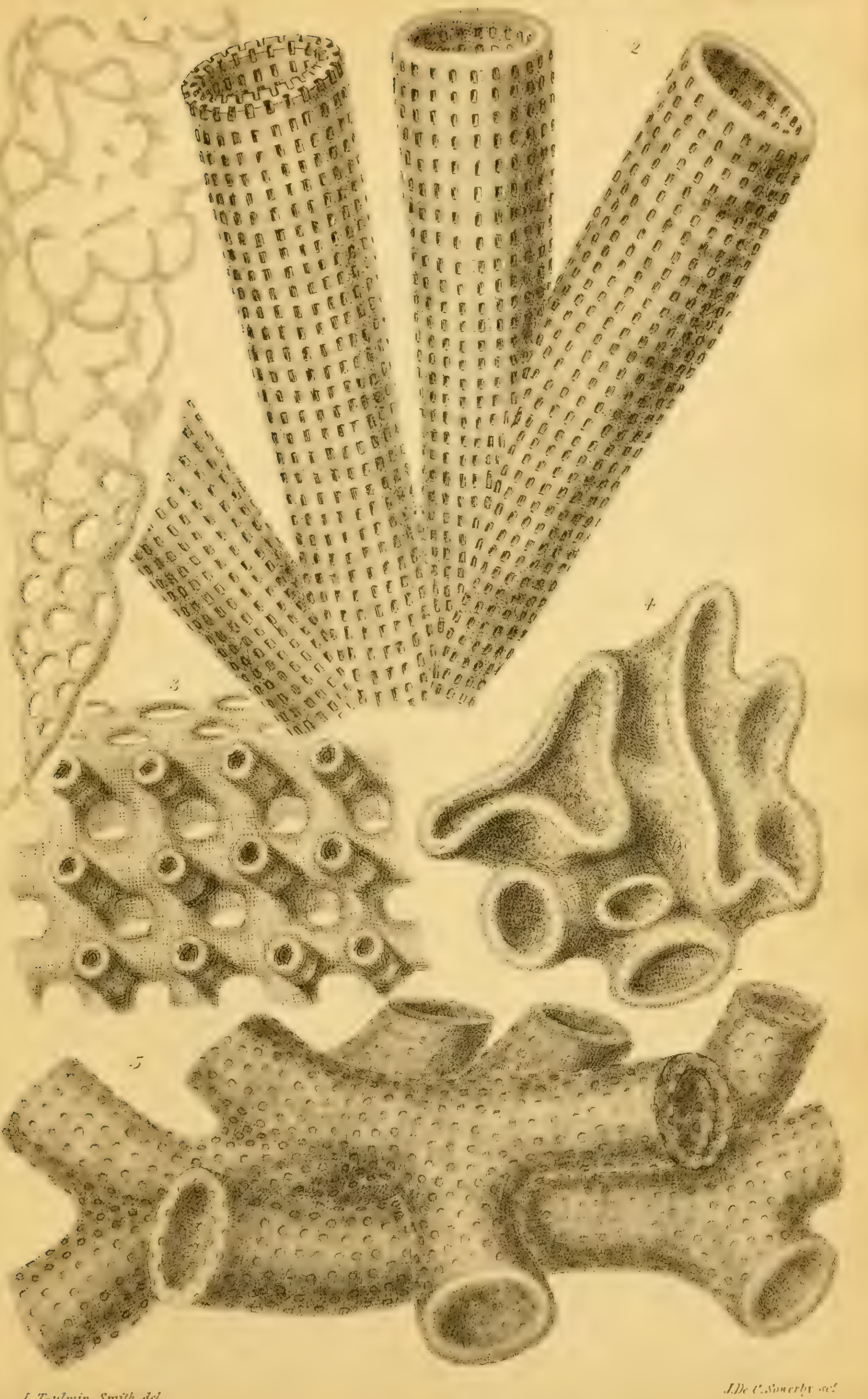

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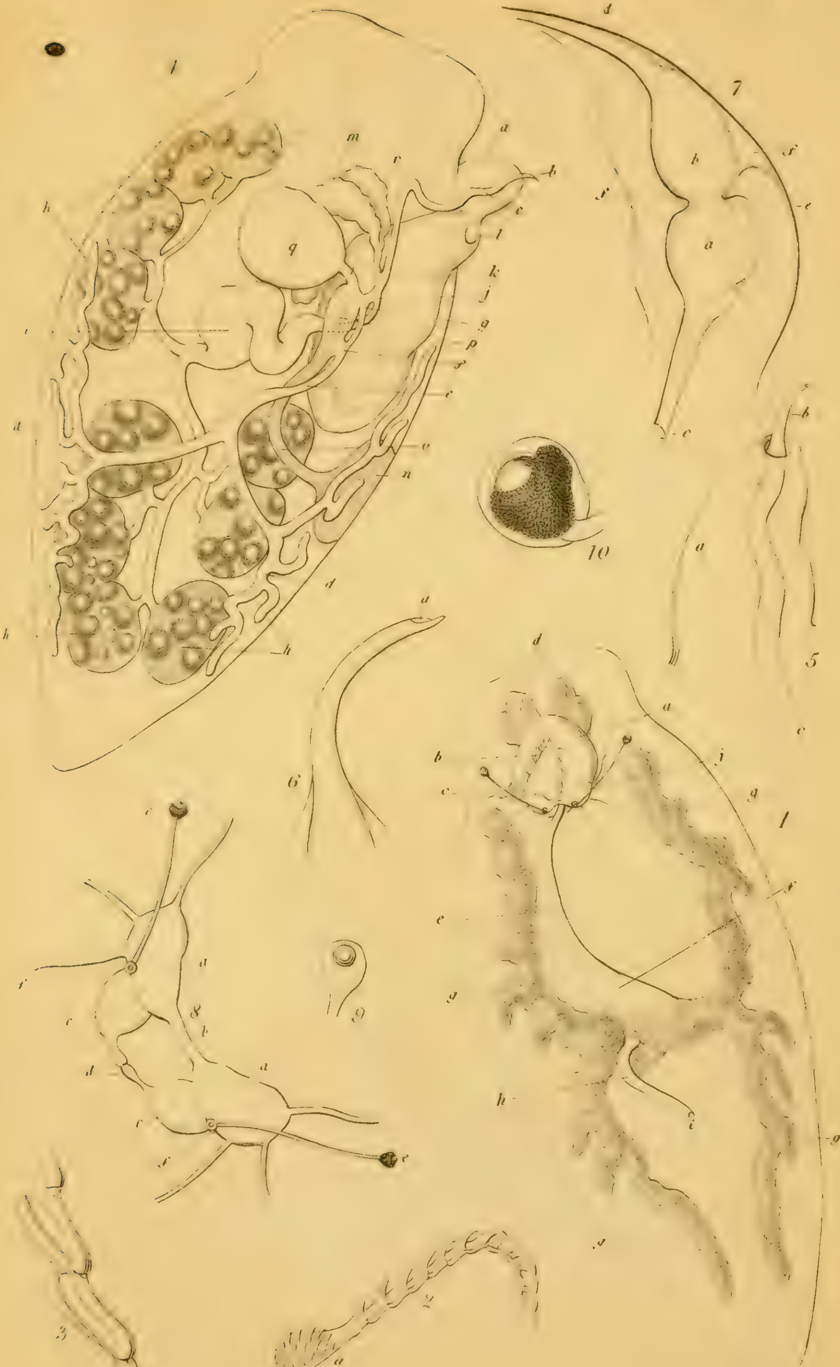

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